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# ON BECOMING TECHNOLOGY FLUENT:
## DIGITAL CLASSROOMS AND MIDDLE AGED TEACHERS

By

Sandra Kay Plair

A DISSERTATION

Submitted to
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DOCTOR OF PHILSOPHY

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# Abstract

## ON BECOMING TECHNOLOGY FLUENT:
## DIGITAL CLASSROOMS AND MIDDLE AGED TEACHERS

By

Sandra Kay Plair

This dissertation, organized in chapter format, is comprised of a collection of case studies designed to explain why some teachers are not prepared to meet the challenges of the National Education Technology Plan despite the pervasive evidence of technology in our personal and professional lives. The first case study is the personal history of one teacher who "battles the machine" and is reluctant to alter what works in her current practice. The next chapter is a multiple case study that examines the issues and challenges experienced teachers faced in their efforts to become more fluent in the use of educational technology. Using an extensive technology related professional development event as an intervention, the study explores teachers' use of technology before and after the inservice, the role of professional development in building technology skills, and matters related to the sustainability of skills. Teachers stressed the need for ongoing support in the form of a knowledge broker to assure continued efficacy and proficiency while integrating technology into their content and their practice.

The fourth chapter, after a five year lapse, revisits two teachers from the previous multiple case study and introduces a new tech savvy teacher who shares her experiences as a new integrator of technology. Self report is used to examine the issues and challenges these experienced teachers faced in their efforts to become more fluent in the use of educational technology. The teachers in this multiple case study participated in a number of technology related professional development interventions over a period of

approximately four years. This chapter includes their reflections on the successes and failures as they continue to grapple with the challenges of increasing their technological, pedagogical, and content knowledge or TPACK and create change in their practice.

Included is an essay presenting a proposal for a framework of five phases of professional development to support the federal government policies of No Child Left Behind and the National Education Technology Plan. The framework is upheld by five principles of professional development considered crucial for effectively changing teacher practice to incorporate instructional technology into the curriculum. By superimposing these principles: duration, content, active learning, and collaboration, this essay then positions technology related professional development as ongoing with the support of professional learning communities or networks and knowledge brokers as a means of sustaining and expanding the efforts teachers make toward technology fluency.

The concluding chapter discusses how education systems constrain teachers' effort or ability to changes. Recommendations are provided on how relations among teachers and institutions might be reconfigured to promote more and better professional learning and practice in technology,

# Acknowledgement

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More than anything I am grateful to my husband, Ronald Fairnot, who believed in me every step of the way. His support and encouragement were never ending though I think he was as surprised as I was when at the age of 56 I decided to return to the life of a college student.

I would also like to thank Pamela Thomas and Sharon Bernard for constantly letting me know how proud they were of their mother becoming Dr. Mom.

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# Chapter 1

## Introduction

Technology permeates almost every aspect of our lives and our society. From the supermarket check out counter to the dentist office, some form of technology can be found and reliance on it is everywhere. Classrooms, or schools in general, seem to be the last institutions to embrace technology, especially as an instructional tool. With the emphasis in recent years focusing on student learning of STEM – science, technology, engineering, and mathematics, –the need for classrooms to include technology rich curriculums has increased. This can only be accomplished if teachers are prepared to offer instruction that is rich in technology. Part of the reason for the late arrival of technology in education is due not to lack of funding, but the lack of technology fluency or technological knowledge among the nation's teachers. This has been especially true for experienced teachers, that is, those with fifteen or more years in the classroom. While computers have been available for classroom use for almost thirty (30) years, not all teachers have embraced their use or many other technological innovations to the degree that technology is the norm for instruction and student learning.

In recent years the federal government has become more involved in changing the dynamics to assure technology is a more integral part of the learning process for the nation's students. The National Educational Technology Plan (NETP) (Partick, 2004) and No Child Left Behind (NCLB) legislation included technology competency for students with an assessment for the nation's eighth graders. These two government driven mandates required K – 8 teachers to reevaluate their teaching practices and their curricula in order to infuse technology into their content. Data from the National Center

for Education Statistics (NCES) found that experienced teachers, 65% of teachers included in the study, were less likely to use technology in their classrooms (NCES, 2003; Prasad, Lewis, & Farris, 2001). With only 35% of the nation's remaining teachers self reporting as being prepared or likely to use technology in their classroom, the future of the nation's students becoming technologically competent seems unlikely. For experienced teachers, with little prior knowledge of technology, learning to be fluent in technology has been frustrating and stressful. Many have been avoiding the use of technology either personally or professional. For some teachers technology has been viewed as just another educational fad destined to fade away at the entrance of yet another promising solution to add to their repertoire. However, with a national focus on the failure of schools to prepare students for the information age or knowledge society (Hargreaves, 2003) teachers have been forced to assess their inadequacies in the area of educational technology. While the literature points to generalizations to explain why there is a lack of technology fluency (Ertmer, 1999), studies explaining individual decisions by experienced teachers to avoid technology are sparse.

The purpose of this dissertation is primarily to give experienced teachers a voice as they share their experiences on their way to increasing their level of technology fluency. By sharing their reflections they help us to understand why the change to technology infused instructional practices has been delayed and how we might help teachers and others involved in educational change when the next educational reform surfaces.

## Defining Terms

Before proceeding it may be beneficial to clarify how critical terms are referenced throughout this dissertation. The terms *technology, technology integration, technology fluency,* and *technology integration specialist* carry different connotations among the advocates of technology in education.

*Technology,* in this dissertation, refers to the myriad of tools available for classroom use. Computers no longer represent the primary technological advances found in classrooms. Students are exposed to digital cameras, graphic calculators, hand-held computers (PDAs), flash drives, cell phones, and MP3 players/iPods both in and outside of classrooms. Teachers have available video projectors, SmartBoards, and document cameras changing the ways instruction is presented to students plus a wide variety of software applications both on and off the Internet. The computer is one component in an array of innovative tools now available for instructional purposes.

*Technology integration* is the seamless incorporation of technology skills into instructional content and practice. Technology integration is a goal for teachers to attain by melding pedagogy, content, and technology (Hawkes, Halverson, and Bockmueller, 2002; Pierson, 2001; Koehler and Mishra, 2005) in ways that support and enhance student learning. Technology integration is the way in which teachers use technology to promote and enhance student learning using a variety of technology tools. It is not merely adding drill and practice software as classroom rewards (Pierson, 2001; Becker, 2000) or ways to fill student time when assigned activities are completed. Teacher use alone (preparing lessons, recording grades, or preparing slide shows for lesson delivery) is not indicative of technology integration. Providing ways to reinforce computer skills,

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such as having students convert homework essays to word processed documents, should not be confused with technology integration. This is a keyboard skill reinforcement activity rather than an example of integration of technology. True technology integration renders the technology as "invisible" (Trotter, 2005). The role of technology becomes a commonplace part of the classroom environment used by students and teachers as routinely as paper, pens, and textbooks.

Since technology integration refers to the infusion of technology in the curriculum, content area, or subject matter, teachers will need to acquire new skills to meet this change in pedagogy and accommodate changes in the culture of classrooms. Rather than isolated technology related skills such as the creation of a word processing document or the ability to save and retrieve files, technology integration utilizes simple to complex technology related skills to support the learning of subject matter or instructional objectives. Combining Internet research with desktop publishing to create a newsletter exhorting the injustice of taxation without representation is but one example of technology integration. Creating this desktop publishing product may be one of many technology components melded in a unit of the causes of the American Revolution. A process for students to collaborate online, such as Google Docs, while preparing such a newsletter can lead to changes in classroom dynamics and the practice of teachers.

*Technology fluency* might best be explained as a state in which teachers and students view technology as a seamless, fluid part of instruction and student learning (Resnick, Rusk, and Cooke, 1998).

*Technology integration specialist* is introduced in Chapter Five and refers to a resource or "knowledge broker" (Oldham & McLean, 1997) whose purpose is to support

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and advocate for the integration of technology into the curriculum throughout the school. This broker of knowledge should not be confused with technically trained staff responsible for the "nuts and bolts" (Marcovitz, 2000) or hardware support, school web page design and maintenance, network administration, or school wide software installations. The technology integration specialist's prime function is that of an agent for changing teacher practice and providing an information channel (Coleman, 1988) or conduit guiding teachers through various technology options appropriate to a specific content. Experienced classroom teachers with strong technology related skills who excel at blending pedagogical, content, and technological knowledge while creating opportunities to enhance student learning would be ideal candidates for supporting less skilled teachers.

It should also be noted that it is not my intent to present or advocate an all encompassing approach to using technology in classrooms. Technology is a set of multifaceted tools that can be selected from an assortment of educational resources. There is value in using technology in classrooms for teachers and students. However, not every aspect of the learning experience requires the use of technology. In fact, it may be the worst choice for certain learning practices. I do contend that teachers should be aware of technology alternatives for engaging students and enhancing learning and through this dissertation I hope to reveal the trials, struggles, and difficulties encountered by experienced teachers who have found it challenging to become fluent in technology.

### The Role of Educational Technology for Teachers and Students

In the struggle to support teachers' efforts to become more fluent in technology lies the need to understand why technology should be a part of a teacher's repertoire and

students' learning. Despite the ubiquitous presence of technology in our daily lives, how this same technology should be infused into classrooms is often challenged (Cuban, 2002). Hargreaves (2003) conversely noted that because of changes from an industrial society to one where information and knowledge dominate the economy, skills for the 21st century are markedly different for those needed to prepare workers for industrial, manufacturing employment. Being able to create, communicate, and collaborate in a global economy drives the skills needed in an information age society. Employers need innovative and critical thinkers to maintain a competitive edge in a global marketplace. Our students need to be prepared to meet those needs and our teachers need to be able to help them to achieve 21st century skills. As the Internet continues to make information and others more accessible, students will need to learn how to be responsible digital citizens. They also need the skills for discerning the validity of the information acquired from electronic resources.

While teachers must be prepared to lead students in this era of information and ubiquitous technology; they, also, must be prepared to function in a different more technology rich classroom environment. The Internet has become an invaluable resource for finding content, retrieving critical curriculum information, for supporting the differentiation of instruction, using data to make instructional choices (Hobe, 2010) and a place for cost effective professional development. Increasingly for economic reasons as consumers we are being directed to online resources for the services once distributed in the form of paper copies. Payroll, banking, and prescription refills must be retrieved using a company's online services. Today's students may never see a paper payroll check or bank statement in their adult lives. Schools and classrooms will be the places to

prepare them for a world that does business from anywhere in the world, at any time of day, using some form of technology.

The dilemma for most teachers is how to integrate technology into their current curriculum without sacrificing their content. Many teachers are still trying to teach technology instead of teach with technology. Harris and Hofer (2009) encourage teachers to rethink how they plan for the use of technology in their content lessons. The authors suggest teachers change their approach to integrating technology by thinking of how it -

- Focuses on students' standards based learning needs rather than the specific features of particular tech tools and resources
- Is easily adaptable to multiple teaching styles and levels of technological proficiency
- Can be learned and applied relatively quickly, with few, if any, additional resources required, even in resource-scarce settings
- Is predicated upon teacher ownership of the planning and implementation process to ensure long-term use (p. 23)

Hofer and Harris (2009) have begun a collaborative effort to create informal taxonomies matching curriculum activities with a particular set of educational technologies that effectively support each activity. These informal taxonomies are being developed as a tool for teachers to increase their technological knowledge to match their pedagogical and content knowledge or PCK. (See examples of work in progress at http://activitytypes.wmwikis.net) This added competency creates TPACK or Technological Pedagogical And Content Knowledge and according to Koehler and Mishra (2005, 2008) teachers can no longer limit themselves to knowledge of pedagogy and knowledge of their subject matter. Shulman and Shulman (2004) identified able teachers of today as those who have the ability to use technology daily in the life of a classroom when preparing for and delivering instruction.

McCrory (2006) suggests we consider the 'affordances' for learning using

technology. With technology students have the opportunity to engage in meaningful

learning experiences such as:

- Representation: Providing representation of ideas and processes that are difficult or impossible to represent without technology
- Information: Providing access to data and content
- Transformation: Changing the nature of tasks in which students engage
- Collaboration: Facilitating communication and collaboration with peers and experts (p. 145)

Additionally, McCrory offers 'affordances' for teaching with technology that "support the work of teaching for meaningful learning (p. 148)." She encourages teachers to consider five dimensions in which technology (from pencils to computers) can support teaching.

- Boundaries: What are the topics the technology supports and where will students work on them?
- Stability: To what extent, and at what pace, will the technology change over time?
- Authority: To what extent does the technology provide authoritative content?
- Pedagogical Context: To what extent, and with what tools, does the technology support managing, monitoring, and evaluating student work?
- Disciplinary Context: To what extent and in what ways does the technology provide a coherent flow of ideas in the domain or structure the development of skills or processes? (p. 148)

Finally, McCrory reminds us that not every type of technology fits every dimension.

Teachers need to make every effort to understand the appropriateness of a given

technology as they consider adding technology to their learning activities or to their

practice.

In order to support teachers in this process of technology fluency, as with any

reform, teacher learning considerations are critical. The research literature reminds us

that teachers, as adult learners, have agency over their learning (Davis & Krajcik, 2005)

which implies they are able to choose what to learn and often when such learning is to

occur. Since teachers learn through the actual act of teaching, learning is situated in the

daily practice of teaching (Putnam & Borko, 2000). While subject matter is a primary

goal for teachers, a strong sense of pedagogy combined with technological knowledge are

also important for teaching the 21st century learner. According to Shulman and Shulman

(2004) teacher learning requires vision, motivation, understanding, practice, reflection,

and community. King and Newmann (2000) contend teacher learning must focus on

student outcomes, incorporate opportunities for experimentation and study, allow for

collaboration, and include teacher influence over professional development decisions.

Davis (2003) in her work, "Change is Hard" encourages professional development

providers to acknowledge that some degree of 'dissonance' is required before teachers

are willing to change their existing practice. Some teachers are willing to change solely

for the chance to do something new and different in their classroom, especially, if they

believe it will enhance the learning of their students. Davis also points out that any

professional development experience must provide a modicum of time for teachers to

maintain and sustain new practices.

### *Purpose of the Study*

This dissertation, qualitative in nature, is organized as a series of individual and

independent essays of case studies focused on the following interrelated research

questions:

- How do experienced teachers rationalize excluding educational technology from their practice?
- What obstacles do experienced teachers face once the decision is made to become fluent in technology?
- How does the theory of "knowledge brokering" support technology fluency especially for the experienced teacher?
- What changes in existing professional development experiences will promote increased fluency in technology?

In the chapters that follow, the voices of teachers have been used to bring greater understanding to the difficulties teachers encounter while working to change their practice. The teachers include a university instructor and K – 12 content area teachers. Most of these teacher participated in extensive technology related professional development outside of contractual hours and without additional compensation. They encountered a variety of obstacles along the way and received less than significant support from local or district administrators.

Within these chapters, teacher change and teachers as learners are emphasized. None of these teachers have been directed to change. In other words, infusing their curriculum with technology was not part of any reform mandate at the local level. This lack of 'requirement' is often at the heart of why the integration of technology has been avoided and teachers have been allowed to include technology as an option for how they present instruction or how they help students to learn. Each teacher has chosen her own path and the only commonality may be the researcher who also functioned as facilitator for some of the technology related professional development mentioned in their individual stories.

### *About Research Design and Methods*

Case study, with data collected through semi-structured interviews, and portraiture were used as the research methods for this dissertation. These methods were selected as being better suited to accommodate the open ended questions used in the interviews and for creating the narrative. I decided these methods provided the best options for meeting my goal of 'getting inside the heads' of my experienced teacher subjects.

*Seeking Understanding Case by Case*

Case study method was selected because much can be learned when attention is directed toward a single case (Stake, 2005). Using cases would allow for a more individualized examination of the research subjects. Both intrinsic case study, the case of a university instructor, and instrumental case study (Stake, 2005), with multiple cases, made it possible to investigate a specific subset of teachers, those identified as experienced with at least fifteen years in the classroom, and the phenomenon of becoming fluent in technology. This method was also useful for identifying any patterns of behavior that might be meaningful for interpreting how subgroups might function (Stake, 2005) within the larger group. Further, as Stake explains, the case study method creates a way for the researcher to "understand the case in the most expected and respected ways" passing "along to the readers some of their personal meanings of events and relationships ... reconstructing knowledge (p. 455)."

Yin (2003) provided the structure for the analysis of the interview data collected. By using theory-building structures a sense of organization and order was created from seemingly disconnected data. The theories or themes were used to break down areas of commonality and identify differences from each teacher's individual story. Later these structures were reexamined using cross-case analysis (Yin, 2003) to form a set of generalizations from all the cases within a particular study. With this option I could focus on the individual teacher first and then redirect the focus to the group as a whole. This made understanding of the problems of technology fluency clearer and pointed out any overarching theories about possible causes and solutions.

The multiple cases used in this dissertation followed the same basic format for the collection, analysis, and the reporting of data. Teachers were interviewed using a semi - structured interview protocol with probing questions interjected in spaces to provide clarity or where the context took an 'interesting' turn. All interviews were audio recorded then transcribed and reviewed by the researcher. The research questions for each set of cases were used to guide the creation of the narrative including some data which revealed unexpected information that took on more of a presence then initially anticipated. Data was coded thematically and each case was analyzed using theory building structures followed by a cross case analysis to develop generalizations where possible. All teachers, with the exception of the university instructor, were interviewed in their classrooms to encourage a more informal, relaxed setting in which to paint their portraits.

### *Using Portraiture to Paint a Narrative Picture*

Portraiture was selected as the method for narrating the stories of the various teachers in the cases presented. My relationship with the teachers had already been established and since I would continue working with them as a facilitator for professional development, I recognized that the relationship between the subjects and the researcher could potentially influence my ability to remain completely objective. Portraiture as a method is based on the relationships that emerge or evolve between the researcher and the subject(s) and encourages a sense of informality unlike other research methods. Using this method allowed me to paint a picture while creating a work that includes "both analytic rigor and human connection, both inquiry and intervention (Lawrence-Lightfoot, 2005, p. 10)." As a result the reader will find my voice interspersed through out the

narrative of the cases. This interference occurs in an effort to "shift away from questions that emerge out of perceived gaps in the academic literature to research seeking to respond to problems in the field" (p. 8) – that is, how are experienced teachers coping with the need to be fluent in technology? The use of portraiture permits my voice to be peripheral and occasionally central. The nature of this method introduces "the person of the researcher" (p. 11) that is more apparent and discernible than other research structures (Lawrence-Lightfoot, 2005).

Using this method I tried to give life to the teachers so that their plight might be better understood as seen through the eyes of an intimate who has often worked side by side with them. In essence, the "voice of preoccupation" (Lawrence-Lightfoot & Davis, 1997, p. 93) shapes the lens through which I see my colleagues. As an educational technology advocate, an educator, and a trainer of teachers, I have expectations and standards that differ from other researchers with dissimilar backgrounds. Occasionally, my "voice as autobiographer" (p. 95) slips into the pages though I have tried to minimize these instances to places in the narrative where clarity and interpretation evolve though a more 'knowledgeable' perspective associated with my personal background.

### *Snapshot of the Chapters*

In the narrative chapters that follow, we encounter one teacher who makes us wonder if efforts toward technology fluency are futile and another who has tried to ride the technology band wagon and decided the ride is not worth the bother after all. We also hear from a group of teachers who share their attitudes about educational technology before and after a professional development intervention. And, finally, we meet two

teachers who are determined to infuse technology whenever it is practical and beneficial to their students.

In Chapter Two, *"I've Never Had an Intimate Relationship with a Machine": Remaining Digitally Distant*, using a case study and portraiture, I examine the attitudes and practices of a single teacher who deliberately excluded the use of technology in her practice. While a number of survey studies attempt to define the barriers (Ertmer, 1999) or the levels of technology competency of teachers (Becker, 1999; Smerdon, Cronen, et al. 2000) the reporting of aggregate data fails to get to the heart of why technology fluency has been so difficult for some teachers. The study of one teacher who declares 'I have never had an intimate relationship with a machine ...' allows us to examine why some teachers seem to be reluctant to embrace technology. The fault may not lie in equipment shortages, lack of expected support, or time to learn new uses (Ertmer, 1999). Perhaps a teacher is simply fearful or apprehensive of any innovative tool found inside or outside of a classroom. This chapter looks at just such a teacher who sees no reason to change her practice to include technology. Her belief in the technology is overshadowed by her avoidance of technology. In this case study or portrait of one teacher, the subject and I, try to determine what issues prevent the inclusion of instructional technology as a part of teacher practice.

Chapter Three, *From Whence Cometh My Help: A Case of Professional Development*, examines ways in which issues of professional development of teachers impacts the sustainability of skills. This chapter includes several cases of experienced teachers who had recently completed an intensive technology related professional development. Narrative in format, the chapter examines experienced teachers personal

and professional use of technology before and after the technology related professional development. Teachers also reflect on some of the issues and concerns they faced while attempting to gain 21st century skills. Since professional development plays an important part in teacher learning, experienced teachers shared their ideas about effective professional development especially as it related to technology. The study also attempts to delve into issues of sustainability once knowledge has been acquired. Rapid changes in technology means teachers need support that continues after their time with facilitators and workshop leaders is over. The concept of "knowledge brokering" is introduced in this chapter.

Chapter Four, *Tale of Three Teachers: "Running as Fast as I Can,"* also a multiple case study, revisits two teachers after a five year lapse. A new teacher, one with prior knowledge of technology, is introduced because of her late in career encounter with technology integration. The chapter explores the ways three experienced teachers have been coping with the challenges of becoming and remaining fluent in technology in the ensuing years since the initial interventions. Semi structured interviews and portraiture are the methods used to develop historical portraits of three teachers. Within the life history format, these teachers were asked to discuss innovations available during the course of their teaching careers. Technology takes on a Postman (1993) perspective when we explore the use of classroom innovations such as opaque projectors, tape recorders, and overhead projectors. The interview data permits scrutiny of how attitudes toward technology integration have altered or become more established. Through their eyes we gain a perspective of how teachers deal with the complexities of including technology in their practice.

The study was designed to examine the efficacy of professional development techniques for promoting technology fluency. The teachers in these cases wanted to move beyond learning about how technology works to learning how to integrate technology into their content (Windschitle & Sahl, 2002). They also wanted to motivate students as a path toward increasing student achievement. Constructed as life histories, these accounts were designed to seek out similarities to help understand what motivates teachers to become late adapters (Rogers, 1995) in changing or altering their practice in the area of educational technology. Did these teachers succumb to Ertmer's (1999) findings that barriers of time, support, and adequate training influenced their move away from fluency? What kinds of professional development activities might have altered their choice to delay or avoid implementing educational technology as part of their teaching practice? Once the decision was made to become technologically fluent, what processes did these teachers use to meet their goals? Finally, what techniques or resources were identified as most efficacious for them within their content area and personal growth?

Chapter Five, *Shifting the Professional Development Paradigm: Coaches, Cheerleaders, or Both*, takes a dramatic turn from empirical research to a call for changes in policy. Persuasive in nature, this essay calls for the revamping of the current professional development model to challenge the way technology fluency is handled particularly for experienced teachers. Focusing on the theories of "knowledge brokering," the essay first examines generalized notions of effective professional development and then expands them to accommodate a framework for the "knowledge broker" as support for technology fluency. While conceding that "knowledge brokering" may be beneficial to all teachers, this form of technology related professional

development for experienced teachers, who are often reluctant to change, may be more appropriate and appreciated.

To begin the process of developing technologically fluent teachers, I argue that quality time, targeting content, active learning, collaboration and collegiality, and ongoing support are the rudimentary requirements for effective technology related professional development. While much of the literature about effective professional development literacy includes eight categories (Hawley, 1999), in this essay I have selected only those categories most likely to promote technology fluency:

- *Quality time* – longer duration professional development events allow for more variations in learning and time for elaboration and the fine tuning of skills (Cohen & Hill, 2000).

- *Targeting content* - educational reform studies noted that teachers were more likely to alter their practice when professional development focused on content (Desimone, et al., 2002) and not generalities.

- *Active learning* - teachers need opportunities to manipulate, explore, and grapple with professional development content (Desimone, et al., 2002).

- *Collaboration and collegiality* - effective professional development is often categorized as learning in a shared environment where participant interaction is an expectation (Hargreaves, 1999; Zhao & Frank, 2003)

- *Ongoing support* - Sugar (2005) points out the need to focus on those teachers "who do not feel confident using computers and other technology tools in their instruction. (p. 549)" beyond the initial inservice.

Knowledge brokering theory is introduced into the professional development equation as an extension of ongoing support. I use the theory of knowledge brokering as a framework for sustaining technology fluency through professional development especially where experienced teachers are concerned. The concepts from Oldham and McLean (1999) are used to argue that the knowledge broker is critical for the ongoing support component in technology related professional development. White's (1987) notion of the teacher as a broker of scholarly knowledge is paired with Wenger's (2000)

inclusion of knowledge brokers as explorers of uncharted areas tasked with bringing knowledge back to the community for its benefit.

Each of these writers offers viable solutions to providing experienced teachers with the knowledge they need through a different paradigm of the traditional professional development configuration. Changes to how teachers prepare to infuse technology into their pedagogy, their curriculum, and their personal knowledge base will impact the pace at which they develop technology fluency.

### *Limitations of the Overall Study*

There is a possibility for bias to be present in the cases since some of the teachers were colleagues with the researcher and because of the researcher's role as facilitator in the Intel Teach to the Future inservice. Teachers may have wished to 'please' the researcher or attempt to recount information they felt the researcher wanted to hear.

The small sample size of this study diminishes the potential for generalizations to be made about all experienced teachers and their efforts to become more fluent in the use of technology. However, the design of the cases does allow for a more in-depth perspective of teachers that may be reflective of other experienced teachers who are not tech savvy and may, therefore, permit the appreciation for the complexities involved in becoming technology fluent.

Little regard was given to the cost associated with any implementation of technology whether it is for equipment or professional development. Lack of funding is often listed among the barriers to technology integration yet teachers, schools, and districts have found and used creative ways to fund equipment. A conscious choice was

made for this study to assume that cost was not a factor preventing teachers from gaining access to knowledge about technology for either personal or professional use.

The role of leadership was not a consideration for this study despite understanding that principals who are strong advocates of technology often are able to motivate and encourage teachers to use technology by providing the resources they need. Building administrators can be key players in the direction their staff takes to embrace technology for student learning and increased achievement. This concept was deliberately avoided unless a participant specifically made note of leadership. In the cases studied, none of the participants indicated any influence by leadership to encourage or discourage their involvement with educational technology.

Finally, all the teachers in the cases were female thereby leaving any notions of technology fluency for male teachers unexplored. This lapse is due to the research sampling that provided no male teachers able to meet the criteria. Few males participated in the inservice and none met the criteria as an experienced teacher.

# Chapter 2

## "I Have Never Had an Intimate Relationship with a Machine": Remaining Digitally Distant

Despite the almost ubiquitous state of computers and other technology tools available for classroom use, technology integration has not become a routine part of teacher practice. Many second order barriers (Ertmer, 1999) intrinsic to teachers, which "include beliefs about teaching, beliefs about computers, established classroom practice, and unwillingness to change," (p.48) are determining factors in the choices teachers make. Pierson (2001) noted three descriptors teachers used to refer to integrating technology in their classrooms. These references demonstrate the range of what it means to integrate technology. The first descriptor referred to teachers' messages to students which presented views of the computer as isolated from the curriculum and a source of entertainment. The second descriptor indicated teachers' view of the computer as a tool in the classroom to be mastered in and of itself. The final descriptor indicative of a more realistic integration of technology, conversely, saw the computer as an appropriate tool for an activity within the curriculum framework. Successful integration of technology is dependent upon a teachers' vision and the availability of modeling to demonstrate examples of technology integration that support new and better ways of teaching and learning. (Burns, 2002; Ertmer, 1999; Kanaya, Light, & Culp, 2005; Maddux & Johnson, 2005; Pierson, 2001).

Using portraiture, this single subject case study seeks to answer three questions related to teachers and technology integration in schools. How does one teacher describe her relationship with instructional technology? What aspects of her background add to or

detract from her proficient integration of technology? What role might professional development play in supporting someone like her in the area of technology integration?

### Developing the Initial Sketch

This is a case study of a single teacher reported through portraiture as the methodology and, as a case study, it is more intrinsic than instrumental (Stake, 2005). Though the selection of these research tools the goal is to study one teacher's beliefs, attitudes, and actions allowing the reader to make his/her own comparisons with others [teachers] around them (Stake, 2005). Combining these tools with a relationship of trust and a shared understanding of the need to examine a phenomenon, a fellow scholar who understood my motives, my interests and my concerns about teachers and technology became a valuable research resource. As Stake (2005) explains the "researcher can come to understand the case in the most expected and respected ways. … pass along to readers some of their personal meanings of events and relationships … reconstructing the knowledge. (p. 455)." By close examination of one subject on the narrow topic of a teacher and her relationship with technology, Janine's "pattern of behavior may be useful for the interpretation of the functioning of several subgroups" (Stake, 2005, p. 452) such as teachers and teacher educators.

Presenting Janine's story as a case study of one subject allows for a glimpse into the larger body of teachers who struggle to avoid technology while acknowledging its place in the world around them and that of their students. While we cannot explore the minds of all teachers who remain among the "technologically challenged," we can hope that hearing one story will inform us in some small way and provide insights about other experienced teachers (Stake, 2005). Portraiture was selected as a way to tell Janine's

story because of "its ability to document the beautiful/ugly that are so much a part of the texture of human development and social relationships (Lawrence-Lightfoot, 2005, p. 9)." Janine has something to say about her own feelings or concerns that needs to be heard and needs to be shared by others like her. She is taking a risk bearing her soul to an avowed techie and placing herself in a vulnerable position. By using portraiture the relationship between researcher and subject can be minimized by the techniques ability "to produce analytic rigor and human connection, both inquiry and intervention (Lawrence-Lightfoot, 2005, p. 10)."

Meeting as classmates during work on advanced degrees allowed Janine and I to develop a relationship of mutual trust and respect. This relationship made selecting her as a research subject comfortable and reduced the period of adjustment often required between researcher and subject. Lawrence-Lightfoot (2005) noted as researchers "we enter people's lives, build relationships, engage in discourse, make an imprint ... and leave (p. 12)." For Janine it meant openly sharing her personal anxiety about technology and revealing what might be construed as a deficiency in her classroom instruction. In telling her story as portraitist I hope to give voice to her fears and concerns while elucidating the needs to meet the challenges of inviting technology into classrooms and acknowledging the role of teacher educators to do so. The purpose for telling Janine's story is to present a view of the part to understand the whole. For "as one moves closer to the unique characteristics of one person ... one discovers the universal (Lawrence-Lightfoot, 2005, p. 12)."

## Selecting the Portraitist's Tools

This mini-inquiry, in the form of a case study, is a portrait of one veteran higher education teacher who admits to being technologically challenged. Janine[*], as the research subject, teaches prospective teachers how to teach science and is a professional development facilitator for a local community college working with inservice teachers. She volunteered for this study while we were participating in a graduate level course. The relationship as classmates seemed well suited for the use of portraiture methodology as described by Lawrence-Lightfoot (2005) in that as a portraitist creating a narrative that "fully attended to, recognized, appreciated, respected, and scrutinized" (p. 6) Janine was critical for this study. What Janine would provide through the sharing of her professional history would be a look at an instructor of preservice and inservice teachers in light of the challenge presented in the National Education Technology Plan (Patrick, 2004) to include technology rich curriculum in K – 12 classrooms. Janine's story would be used to explore what technology knowledge a teacher of teachers would bring to the issue of preparedness for technology integration. Her sharing would offer a glimpse of this knowledge not only for her own practice but that of students preparing to teach in K - 12 environments.

A ninety minute semi-structured interview consisting of eleven questions (see appendix for interview protocol), which focused on general professional development experiences, teaching experiences, personal use of technology, and technology use in teaching practices, was used to gather initial data. The interview was audio taped for transcription by the researcher. Janine, an experienced teacher, and the researcher also

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[*] Note subject's real name.

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had casual conversations, which provided either clarity or additional information. At least one email exchange occurred in response to a missing probing question not elicited in the initial interview.

### *Exploring the Artist's Palette*

The interview protocol focused on four categories or families of study:

- The subject's knowledge of technology in general;
- The subject's use of technology both for personal and professional use;
- The subject's involvement in professional development activities in general;
- The subject's teaching experiences and practices including but not limited to any related to technology.

The audiotapes were reviewed and transcribed by the researcher. From the transcription, efforts were made to match the subject's commentary with the four families of study noted above. After many iterative reviews of the transcript and the audiotape, the data was analyzed through a lens of teacher change, teacher knowledge, and professional development. Janine's story does much to inform us about how and why teachers acquire knowledge; why teachers are willing or unwilling to change their practice; and what the influence of professional development might have on teacher knowledge or change.

### *Portrait of a Technologically Challenged Teacher*

> *I have never really had a truly intimate relationship with a machine.*
> *(40)*
> *Janine, 2005*

### Historical Perspective

The results of the data analysis were surprising and diverged significantly from the scope of the initial queries. In a very short period of time, Janine, revealed the source of her technologically challenged status. According to Janine, "I have never really had a truly intimate relationship with a machine." (40) Her interaction with anything

mechanical, let alone, technology oriented is adversarial at best. Janine craves simplicity and requires household devices that follow her canon that "I just need the basics." (42) Her explanation raises a challenge for technology advocates: If teachers' techno-phobia can be explained as distaste for technology in most aspects of life, how can we convince teachers to embrace it in their classrooms? However, upon further review, Janine offers a great deal of insight into much about the role of instructional technology from the perspective of a technologically challenged teacher who has watched the cycles of changes in education ebb and flow.

Janine started her teaching career in the middle school and, due to family obligations, left for a number of years to be a stay at home mom. After a brief return, Janine left K-12 teaching again. Her return to teaching was at a community college where she has worked for eighteen years with local area science teachers providing professional development activities to keep teachers current of developments in the state's changing science curriculum. She also teaches other science related courses to the general population of community college students. Janine also teaches at a nearby university while working on her graduate studies.

The first indication that my interview is not going to be focused exclusively on technology in classrooms surfaces with Janine's explanation about her almost phobic relationship with computers. She experiences symptoms one would recognize in situations that elicit fear and anxiety when using what she calls 'The Machine.' "My breathing changes" (63 & 65) or "It takes my breath away," (111) is stated on more than one occasion. Explaining further she noted, "There's something that happens inside my body. I can feel physiologically different headed into a lab that has computers in it that I

am supposed to instruct with (177)." Her fear is based on knowledge that comes from her place in life. Janine shares her images of computers comes from childhood memories of computers portrayed in movies as big cumbersome machines, often ominous in nature. These bulky machines were forever breaking down with merely an ill placed keystroke or some other mishap. "Just the whole concept of pushing the wrong button and having everything stop," (36) explains Janine's dread at the thought of using computers. In her undergraduate years, Janine consciously selected a physics class which had long been avoided, rather than face the fear of crashing the system in her other option of a Computer Science class.

> "I could either take Physics, which has threatened me all of my life or I could take a Computer Science class. Well, at that time, that would be 1971, 70ish, computers filled a whole room. So I bit the bullet and I took physics because I was so terrified." (Nervous laughter.) (36)

This kind of phobia, whether based on imagined consequences or real occurrences, has kept Janine at a distance when using many kinds of technological innovations. For Janine, this is apparent in the simplicity she expects and accepts from the 'machinery' in her life. She relates, "My washing machine is so simple. I don't own a dishwasher. I don't own a can opener. I twist them (hand gestures of turning a can opener). I don't get along with them." (40)

With a bit of coaxing Janine tells me more about other uses of technology in her life. By asking her how she uses 'The Machine' she reveals the use of Word and the attachments she sends with email. She is able to use Excel but cannot construct an Excel spreadsheet. Janine has a printer with fax capabilities which she knows how to use and she has managed to develop her own ways of using the technology around her.

[How do you use technology to take care of the things you need to do as a teacher or as an instructor?] I'm thinking. The first thing that came to my head is just going to be an unusual quote. You may not want to use this as a quote. [Should I turn it (*the recorder*) off?] (Gestures to leave it on.) When I think about what it is I have to do and I'm afraid because life is extraordinarily full and I'm afraid that I might not remember that, I call home and leave myself a message. So, on my phone right now... [So you have messaging on your phone? That's technology.] On my phone right now it tells me three things I will need to do tonight which are for packing the StanoBox, the great big crate I carry of material that I don't want to forget for next Wednesday's class. So I use that technology to help keep order in my life. (202 – 209)

We can observe a paradox here. Though professing to be technologically challenged, Janine seems to be handling the changes and the innovations as well as can be expected.

### *Constrained by Limited Knowledge*

Janine is so convinced that she is lacking in knowledge about technology that her responses to the question about how she uses technology both personally and for her classroom resulted in requests for examples. To Janine, *technology* equals *computer* so any other categories require specifics. Despite Janine's reluctance, she has more skills than one might expect and may not be as technologically illiterate as either of us suspected when the interview began. She has a good understanding of how to use basic applications to make her work more productive. Word processing, email, and the Internet are staples in her productivity tool basket although she states she understands minimally how to function in these applications. What is difficult is determining what skills and knowledge Janine has about technology in general. In our interview it takes a great deal of prodding and probing to find out exactly what Janine actually knows and what she is able to do.

Janine has learned just enough to function in an environment that has a certain degree of expectation, however, at times she must rely on others to accomplish some of her

teaching related tasks. For example, the additions to her syllabus and course pack require a format, that of a typed hardcopy, rather than one that is handwritten. This socially imposed sanction forced Janine to learn the rudiments of word processing which leads to more technology use in that Janine must now learn to use her printer. The printer has faxing capability so she gets to add more to her list. When she is unsure of a procedure or can avoid learning new functionality she calls on a colleague in her office to handle these needs. She uses an output that required tables as an example of a word processing feature she has not learned how to do.

Much of her classroom communication is done by writing on the whiteboards and "I do speak a lot. I do talk a lot" (227) when students need directions for activities. Many of the classrooms she uses are equipped with video projectors but Janine does not use them. She knows what can be done but chooses to avoid the ever-impending danger of losing control of the classroom environment when taking the risk of using what she considers to be untrustworthy technology.

> [In your classroom do you use the overhead?] I do. Oh, no. [The big projector?] Oh, no. The one in the ceiling? [You don't use that either?] Oh, no. That has switches and has all sorts of buttons. Oh no. I don't use that. I use the overhead overhead. ... (124 – 129) To think about hooking up my laptop to that machine that projects is more overwhelming than I could ever think about doing. I would have to come the night before and test it and then, come very early in the morning and reset it up to make sure it worked. I don't trust it. There is a trust issue here. (135)

Janine is also an Internet user and finds navigating through browser software less complicated and cumbersome than other applications. Nevertheless, when a shortcut to access a web site is missing from the desktop of the computers in one of the campus computer labs, she is temporarily caught off guard. She has requested a link to a specific web site be placed on the desktops, but fails to check to see if her request has been

honored. Too her dismay the link is not present "And so I had to very, very quickly I tried to the pour from the memory where MiClimb is located, what the address is and work from there." (157) Fortunately, she is able to remember the location and relieved because "If I didn't have such a strong understanding of where that's located, that classroom would have been a lost moment and a half hour of my precious three hours with those students a week would have been gone." (165)

One could hear the delight in Janine's voice at being able to achieve what seems like a very small thing – retrieve a web address – when the technology has proved again not to be trusted. Janine credits her ability to overcome this potential disaster with her personal effort involved in knowing how to access the site she needed. She has, in effect, focused on the portion of a particular technology and garnered knowledge that is useful to meet a specific need for her classroom. Janine makes it clear she does not want her time with students squandered by technology problems and malfunctions. Fear and anxiety seem to be intertwined when using technology for instructional purposes involving direct student contact.

### The Battle Rages On

For Janine the strife she experiences with The Machine is on-going and she makes a great effort to maintain the upper hand. Queried about this intimidating situation, Janine explains that

> I battle the machine. Every day I am confronted with a new problem on the machine and so you just grin and bear it and sometimes you say vulgar words to it and then you try to get on with it. … but the whole idea of not using it is ridiculous in this culture that we're in right now. It's such a battle. (61)

It is little wonder that she has made the progress that she has. The Machine, marketed by the technology manufacturer as user friendly and helpful, is all too often unforgiving and unpredictable. Janine's anxiety has led to what she calls an "issue of trust."

> I don't trust it. There is a trust issue here. And I can talk about that trust issue. When you depend upon something to work and even though it is already to go and it did work before, there is no guarantee that is going to work when you need it. And if your presentation or your work is counting on that then I have found it very frustrating. (137)

Janine is not willing to relinquish or jeopardize that control for the whims of technology that may or may not work as expected when needed.

> I'm not willing to take that risk. I have X amount of time and if the machine is not working then you spend; you spend precious moments trying to figure out what is wrong. The pressure is intense. I would just prefer to know that I'm ready with materials to do the work that I have to do... (147)

Janine's description of family responsibilities that created gaps in her professional life might help explain what could be construed as a lack of interest in instructional technology and why the battle continues. She has made choices about what she will learn and when.

> I graduated from Western with my undergraduate in 1973, so in the last 40 years it has been truly a revolution in technology. In taking a telephone off the wall and being able to move out to your deck and make a phone call. And now putting this little, tiny, little bitty square in your pocket and it can take pictures and can text and it can do so many things. It's been a revolution in 40 years. If you've been a busy person being a mom and a teacher and a wife and sometimes even being a self, how much more can you put into a day? How much more learning is there?" (338)

The issue of priority surfaces and Janine is clear that when certain choices needed to be made, like learning to be technologically literate, her priorities were, and still are, directed elsewhere. Janine feels badly about not being more technologically aware yet makes no apologies at the same time. She speaks of priorities and the time needed to commit to those priorities. "I am forced to do some of this technology now. I'm

absolutely forced.  And because I'm forced I spend the time but it takes me so much more time to use the technology than to simply write something (347)."  Paired with parental responsibility, Janine's selection in the past has been in favor of her family life leaving her to struggle to meet today's challenges of technology in the classroom after much of the ground work has been laid.

### Developing a Professional Self

The question of professional development is posed in the hopes that Janine has experienced some of the workshops so prevalent in the early days of computers in classrooms.  However, her teaching career has provided little or no exposure to the typical professional development experiences.  She does, however, discuss being mentored in the early stages of her teaching career when assigned as a Special Education teacher, with little background in this area, she was mentored by several experienced Special Education teachers who recognized her lack of preparation.  One teacher in particular joined Janine for lunch each day.  "We had lunch together everyday, but we never ate (32)."  Janine explains her professional development opportunities in higher education as follows:

> [… what opportunities have you had to become more technologically
> proficient?  What kinds of professional development opportunities have
> you had?]  I would have to say I've had very few opportunities.  I did sign
> up to take a basic introductory computing class as a faculty member but
> the class was full so I was unable to do that.  And my schedule just does
> not allow me to much more than I am presently doing.  (101)

Any technology related professional development has been primarily informal especially since Janine prefers to work one-on-one because she feels she needs the slower pace to learn things.  She explains that a colleague at the community college where she teaches helps her in various ways.  Sometimes a peer shows her how to do things and

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sometimes she responds to Janine's requests for items that can be created using technology.

> I have watched *my friend* do the work and then tried to duplicate that task on the machine the next time a similar task is necessary. She is ever so patient and tries multiple times to teach me the functions. *My friend* has served as a personal tutor – providing patient and repetitive instruction. (363)

Janine also a bit intimidated by classmates in technology related professional development who appear to be more comfortable and skilled by comparison. Our conversation below sheds some light on why avoidance and insecurity play into Janine's missing knowledge.

> [Prior to your induction into the Ph.D. program were there not opportunities for you to learn technology?] Probably. There were probably. [And you didn't use them?] I chose not to. [Why? If the may be so bold as to ask.] It takes so long. It takes my breath away. There are these little whippersnappers who are used to technology since the time they were in kindergarten and the pace at which I have to learn is so much slower than what they are able to do it. So even as I sat in a computer class to see if that was the one I needed, I was trying to test to see where I might begin this journey into computer understanding. I wasn't able to keep up with the instruction because it went it's all very fast. So I'm thinking about some of the instruction that they give at senior centers as a very fine place to begin to get some of this understanding. Where the instruction is more one on one and it's slower. (105 – 111)

This leads to queries about how she remains current with new science trends and innovations and she reveals that she does so through her colleagues. "Since I primarily focus on education methods in science and have a broad network of colleagues, I am introduced to programs that apply to the science field in that manner (367)."

Janine projects an image of a dedicated content or subject matter educator determined to create teachers who are well prepared to handle inquiry based science to support student learning. She speaks of the dedicated teachers she works with at Saturday workshops and explains her determination to promote inquiry based practices that

support the state content standards and benchmarks. This focus does not include

technology components and the use of technology comes off almost as an imposition.

> I would just prefer to know that I'm ready with materials to do the work
> that I have to do, because the computer is not that enhancing. It doesn't
> enhance the work that I have to do. Not only the work that I have to do,
> but the work that I do with students. I don't see it as an enhancing quality.
> (147)

She is positioned in a space of comfort for herself and is confident in her choice not

to change what appears to be working just fine.

It should be noted that though Janine indicates she is unfamiliar with technology she

was involved in a program to bring science probes to teachers. Though she understands

conceptually how the probes can assist in soil and water study she does not actually know

how to use the probes. They are not a part of professional development activities she

conducts with inservice teachers or the classes she teaches to preservice teachers.

Teachers receiving probes are trained by the manufacturer and receive a personal probe

in addition to a classroom set. Janine did not receive that training, "because I am not part

of that program. I just helped decide that that would be a good method (261)."

*Collegial Support*

Janine does not plan to include teacher uses of technology in her instruction,

indicating the addition of technology beyond what she currently uses with students will

not enhance what she does. However, there is a university technology requirement for

her prospective teachers and Janine has found a way to compensate for her fear or anxiety

with technology by using the resources around her. Acknowledging her lack of skills,

she uses the human capital on the campus when the need arises. Her rationale suggests

that finding and using skilled colleagues or resource staff would be a simpler solution

than learning the skills herself.

... because I am not trained and I realize I'm not trained, I go to the gentle caring natures of this campus and I pulled up those individuals who are trained to do that. So I find the resources within knowing that ... I've not developed that knowledge base enough to be a meaningful teacher. (271)

So the analogy that I'm drawing here is that if we all have those areas of expertise and we're all able to find those individuals to supply what we are deficit in, it seems to me to make very good sense to use those qualities, those learnings from other individuals in your own class, which is probably why I have been able to escape understanding the machine for so long. (279)

Janine admits she does not have to do this if others are available. She does not, however, create a clear picture of what exactly others do in her classroom though she does mention getting help to teach students web design. Janine justifies this arrangement by relating her vision of new teachers working in concert with experienced teachers.

They're [new teachers] coming armed with a background and understanding of certain technological uses. (289)

And I'm saying the veteran teachers understanding classroom management ... and the system of education. We know that there is a system in learning and administration and all of that. And the elders in that community can provide that information to the newcomers. The newcomers can provide the technology information for the elders. (293)

Janine suggests that some consideration should be given to pairing new teachers, who bring a level of comfort and knowledge of technology, and veteran teachers, who offer pedagogical and classroom management experience. This coupling would form a partnership where each teacher would bring skills for exchange that would be mutually beneficial.

Janine makes no mention of rectifying the circumstances that leave her unable to provide technology integration skills and knowledge to her preservice teachers. Her opportunity to become more comfortable and knowledgeable about technology will come when her degree program ends. "And my schedule just does not allow me to much more than I am presently doing. My promise to me is that I'm going to bite the bullet when

I'm done and I'm going to take a series of classes (101)." Her solution, nevertheless, does little for preparing preservice teachers to stand on their own in their future classrooms.

As we prepare to close our interview our conversation turns to the National Educational Technology Standards for Students, Teachers, and Administrators (ISTE, 2000). Janine is unaware of NETS and how they can be paired with curriculum standards and benchmarks for content area. Asked what needs to happen to make her more capable in her classroom with technology, Janine responds, "I would have to have a lot of practice. ... I just need to have some instruction some one-on-one with my binder close by so I can replicate that time and time again (179)." The unasked question for Janine is – where does that leave the preservice and inservice teachers who face you in classrooms devoid of technology rich curriculum experiences? As researchers in teacher education programs the question becomes - what can be done to assist Janine and others like her in adding knowledge of technology to their teaching repertoires?

### *Interpretation of a Portrait*

The National Education Technology Plan (NETP) (Patrick, 2004) has identified the nation's teachers as lacking in technology related skills that promote and enhance student learning. The plan, presented to Congress in January of 2005, suggests that students bring far more sophisticated technology skills to the classroom than the teachers that teach them. Of particular note is that the data from the National Center for Education Statistics (NCES) (Smerdon et al., 2000) claims experienced teachers, those with ten or more years of classroom teaching, are less likely to be skilled in using technology in their classrooms. Of the over 2,000 schools across the nation, 65% of teachers in the study fit

the category of experienced teachers suggesting if new teachers are more likely to be skilled in using technology in the classroom, then we can estimate that only 35% of the nation's teachers are actually able to provide students with technology rich curriculum. These data imply that many students are left with minimal opportunity to acquire skills the NETP views as desirable. Despite the premise offered in the NETP, Russell, Bebell, O'Dwyer, and O'Connor (2003) in their Use, Support and Effect of Instructional Technology (USEIT) Study reported new teachers were less likely to use technology for instructional purposes and more likely to view technology as having a negative impact on student learning. These conflicting statistics raise questions about how teachers think about technology and their own relationship to it. Janine's story may help us to understand why some new teachers may not be as prepared to incorporate technology in their practice.

Before exploring Janine's lack of technology in her instructional practices and course requirements, a disclaimer may be appropriate. I am not advocating an all encompassing approach to using technology in classrooms. Technology should be a seamless, fluid part of instruction and student learning. It is a multifaceted tool that can be selected from an array of educational resources. There is value in using technology in classrooms for teachers and students. However, not every aspect of the learning experience requires the use of technology. In fact, it may be the worst choice for certain learning practices. I do contend that teachers should be aware of technology alternatives for engaging students and enhancing learning. Preservice teachers, though perhaps comfortable with a variety of popular technology innovations, such as cell phones, Internet research, and social networking, need models and examples of appropriate instructional technology uses.

That few or minimal opportunities are explored limits their scope and diminishes what they will carry to their future classrooms and students. As educators, we have a responsibility to prepare youngsters for a highly technical non-industrial society (Technology Counts, 2005: Hargreaves, 2003; Patrick, 2004) even when we understand the speed at which technology changes.

I leave my interview with Janine to reflect on the deeper meaning of what she has shared with me. My concern for the kinds of experiences preservice teachers receive lingers. What have I learned from Janine's story? What lessons have been presented on how teacher educators fit in the goals of the National Education Technology Plan? What kinds of professional development experienced might be helpful for teachers like Janine?

*Student Knowledge of Technology*

I encountered Janine several days after our interview as she was meeting with her students. It was near the end of the semester and they came to her presenting hefty tomes filled with lesson plans for future students. One student willingly shared her work with me which consisted of neatly organized crisp new worksheets, many produced electronically. When the student left, I asked Janine how much of the work referenced technology use in the classroom. Janine replied, "None." Technology is not modeled or expected as part of the student course work. This discrepancy helps to explain the findings and the data indicating that new teachers are least likely to use or feel prepared to use technology in their classrooms (Russell et al., 2003; Smerdon et al., 2000). Janine has implied her preservice teachers possess enough technology fluency to be a resource for experienced teachers similar to her situation. As she declared in her interview, "They come in understanding and not being afraid of the machine for instruction (291)." The

newcomers can provide the technology information for the elders (293)." The assumption is problematic that preservice students arrive with technology skills and experiences related to their content ready to easily integrate technology into the curriculum.

Carroll and Morrell (2006) studied 49 faculty and 377 students in six small colleges with similar education programs. Their findings indicated faculty and students were "poorly versed in everything from graphics calculators to video editing software (p, 9)." These researchers were most surprised to find that many common technology tools and resources were unfamiliar to both students and faculty. Their findings conflict with Janine's notion of technology smart new teachers blending with technology challenged experienced teachers. Carroll and Morrell remind us that "if it is important to insure that students have technology skills related to the disciplines that we teach, then we cannot assume that the students will come with those skills (p. 9)." And further, "we cannot assume that our students' experiences before they enter our classes will have provided them with the technological expertise required both for teacher education programs and for a lifetime of teaching (p. 9)." Janine's students need the opportunities to, at the very least, learn about technology and its integration into the science curriculum if the goals of the NETP are to be realized.

A hopeful sign from our discussion about student work was Janine's acknowledgement of missing technology pieces and her explanation that she had not seen the need for their inclusion. Adding technology elements even in small amounts had not occurred to her. She explained that she does not know enough to ask her students to do this and vows to be more cognizant in her future classes. Curiously, none of her assumed

technology adept students considered technology as a natural addition to their planning of lessons.

### *Control versus Technology*

If nothing else, we learn that maintaining control of her classroom environment is paramount (Kennedy, 2005) to Janine. Technology use threatens or interferes with this control by virtue of its unpredictability. Connecting this device to that device; starting devices in proper sequence; adjusting this setting; and possessing the right combination of devices and cables can be daunting indeed. It, meaning technology in general, cannot be 'trusted' according to Janine to do what is needed and expected thereby causing her to "lose precious minutes" (147) with her students while unraveling technical glitches. This is just one of the barriers to using technology (Ertmer, 1999) which surfaced when the computer was the newest innovation in the classroom. Diaz (2001) points out, "Most faculty members want to learn things they can use, and can use quickly, to address teaching and learning. They want to become "end users" of technology, not technicians who must stay abreast of every new development in hardware, software, and programming skills." Janine is quite comfortable with the older technology of an overhead projector mainly because it connects to nothing that might complicate its use. Her lack of skills, combined with her fear or anxiety, keep her from trying to change what works consistently and reliably (Kennedy, 2005; Sikes, 1992).

### *Making Use of the Unknown*

From her story we know that Janine is not totally without technology skills. She has mastered quite a number of technology innovations, primarily because she often has no choice. For example, certain documents are expected to be submitted as printed hard

copies, creating the subtle sanctions and norms found in the social networks of the work place (Coleman, 1988), that prompt her to learn the basics for performing work related tasks. She uses a cell phone, though she readily admits she cannot find the contact list, and uses her home answering machine like an automated secretary leaving herself reminders and to-do list items for retrieval later. What is missing is a connection to classrooms where technology laced activities might enhance student learning. Janine has no vision of technology tools in science classrooms where students might record data, design lab experiment instructions, or publish and present findings to their classmates or to others outside of the classroom (Flick & Bell, 2000; ISTE, 2000). Though her husband has created, at her request, an Excel application, she has not made the connection with using this software in a science curriculum. More sophisticated applications such as video streaming, web based or software simulations, or digital and document cameras are seemingly out of the question with Janine's clear understanding of learning goals and objectives that include technology components.

Readers of Johnson's (2002) guide for developing instructional technology skills would recognize Janine as a Level 1 user who lacks knowledge or awareness of various technology tools or uses. Individuals in this category do not identify innovations as being associated with technology or have little or no knowledge of an appropriate, viable technology component. Many in this category do use technology for their personal productivity, but lack the confidence to use it with their students. Surry and Land (2000) cite the lack of faculty awareness of technology and use in teaching as problematic for higher education.

As we draw from Janine's story and try to make sense of her unwillingness to use technology or include it in her courses, we can see that despite the anxiety she feels Janine simply lacks the knowledge to use the innovations available to classrooms. This may be a critical part of the story. One cannot be expected to use or demonstrate the unknown (Diaz, 2001; Spotts, 1999; Surry & Land, 2000). As an experienced teacher and teacher educator the question arises – why is Janine lacking in knowledge? Her choice of priorities may offer an explanation since Janine has made a conscious effort to move technology fluency down her list of things that matter. She explained her choices clearly, "If you've been a busy person being a mom and a teacher and a wife and sometimes even being a self, how much more can you put into a day? How much more learning is there (338)?" When teachers express concerns of not being as skilled at their students, Janine's articulation of the issue is very convincing.

How does one find the time to develop the technology fluency that does not impact the structure of existing teaching practices or infringe disproportionately on teachers' personal time? This quandary is reflective of Huberman's (1993) life cycle of teachers when female teachers in the Stabilization phase, that period when teachers experience a sense of balance in school related responsibilities and balance between home and school, often placed family life above their teaching careers. In addition to sacrifices in time, teachers are selective about what they chose to learn (Huberman, 1983) and are willing to make changes that make sense to them (Sikes, 1992). While technology related professional development is just as critical for university faculty as it is for teachers in K – 12 environments (Diaz, 2001; Spotts, 1999; Surry & Land, 2000), finding the time for learning is difficult for both groups.

In one of our informal chats, Janine explained that she found the data gathering process or the interview experience to be a form of professional development. It gave her an unexpected opportunity to talk to a knowledgeable actor (Coleman, 1989) about an area that was mysterious and perplexing for her. Her explanation of the benefits she found in having these kinds of discussions indicate teachers and teacher educators need more of these conversations and opportunities to share and question in non-threatening environments.

Although Janine keeps abreast of science curriculum changes, she makes no mention of a place for technology in the science curriculum. Her lack of knowledge regarding available technologies begs the question - where do teachers learn about appropriate technology tools for use in their classrooms or how beneficial those tools might be for teachers and students? Flick and Bell (2000), in their work to prepare "Guidelines for Using Technology in the Preparation of Science Teachers," remind us that the field of science is the harbinger of technological innovations. It is the availability of various technologies that bolster the innovative ideas of others. That a science curriculum should be devoid of technology experiences presents a certain level of irony. Perhaps, after all, the real culprit for Janine is the lack of an adequate frame of reference to help her move herself and the preservice teachers she instructs into the 21st century classroom forecasted by the National Education Technology Plan. How to get her and others like her better situated should be the concern of staff and professional developers and the teacher preparation institutions.

### *Final Thoughts*

Janine as a technology avoiding educator is puzzling. While she professes to know little, she has quite a bit of technology under her belt. After examining the transcripts of our interview I found twenty-three (23) instances where Janine either used or understood some form of technology, most of it suitable for use in a classroom. Contrast this finding with twelve (12) instances where she expresses fear or discomfort with "The Machine" and one could conclude that she is not as bad off as even she might expect. The disconnect occurs when, though she acknowledges technology is important in the classroom, she does not require its use by her students. Her students, according to Janine, are more comfortable with using technology than she or the mentor teachers they will encounter.

But is it the lack of knowledge about how to integrate the technology in the content that creates the problem? Thompson and Mishra (2007) celebrate the link to Shulman's (1987) PCK or pedagogical content knowledge with the acronym, TPACK. Coined to represent technological and pedagogical content knowledge, TPACK affirms the need to include technology instruction into pedagogy and into content. Janine, we might surmise, does not have the knowledge to do this. One might conclude that her lack of technology know-how interferes with any notions about using technology as a tool for learning. Even while she acknowledges that students should be using technology, she does not see herself as the teacher for such a classroom. Janine's conundrum belies Ertmer's (2005) arguments about teacher belief being the solution to technology integration. Janine might believe in some respects the importance of including technology; she just does not see the change with her at the helm.

Many educators will appreciate Janine's fear of losing precious minutes should the technology fail in some way. Recalling the incidence of the missing Desktop link, Janine is not comfortable relinquishing control to the whims of technology. Whiteboards, paper, and her own voice continue to support the goals for her content in reliable ways. For her, the use of technology does not enhance what she needs to do for her students.

This choice seems to create some internal conflict for Janine. While she admits that technology must be included in the process of education, she does not see herself as being the one to do that. Not only does she not know enough, she points out the she and others like her, veteran teachers, can not learn enough quickly enough to meet the need. Someone else must take up the gauntlet and be the technology using instructor. She knows intuitively that she needs to change something but feels powerless to do so.

Janine's circumstances remind us that while veteran teachers and teacher educators remain outside of the technology loop, the potential exists that their students will also remain outside. Downloading tunes for iPods, emailing family members, chatting online with friends, and surfing the Internet for the latest games are not truly reflective of the technology structure of the workplace. Assuming that students who are comfortable with these tasks are also completely technology literate is a fallacy (Plair, 2007). Although it could be argued that some of these skills are precisely what is used in the workplace, students should be the knowledge creators (Hargreaves, 2003) preparing their own podcasts of science results and experimentation. Email correspondences to experts in a variety of scientific disciplines to complement a unit of study helps students extend their search for information and knowledge beyond the classroom. Using the Internet to

retrieve, sift, and assess information in a variety of formats should be part of the learning experience for students at all levels.

Hargreaves (2003), in his work on teachers and the knowledge society, argues that the skills needed for the non-industrial workplace require problem solving, creativity, and innovative thinking. According to Hargreaves, the use of technological innovations will drive how workers meet these requirements as knowledge workers of the future. Teacher educators have a responsibility to prepare preservice teachers for classrooms designed to develop Hargreaves' knowledge workers. Meeting this need for technology savvy teachers and teacher educators requires changes in attitudes and beliefs and a willingness to accept innovative ideas and tools.

By not including technology in her methods course, Janine misses the opportunity to prepare her preservice teachers for using technologies to construct, present, and share knowledge in real life contexts (Vrasidas and McIssac, 2001). Further, technology has the potential to be used for active, cooperative, and authentic activities grounded in constructivism where learners construct their own meaning in concert with their prior knowledge or experiences. Preservice teachers need to understand which technology tools allow students and teachers to share meaning and construct knowledge. Maeers, Brown, and Cooper (2000) offer four reasons for preparing preservice teacher to integrate technology.

1) The availability and currency of resources means knowing how to access, evaluate, and select appropriate technology tools for a given content.
2) Employers want technology savvy teachers to effectively use their investment in digital tools. Preservice teachers need to see faculties of education schools model effective uses of technology.
3) Accessing standards and benchmarks from online data bases from cash strapped state departments of education will be required for many new

teachers.  Preservice teachers should know how to retrieve data related to their content and have knowledge of other online resources.

4) Educational technology methods included in content courses rather than isolated computer or technology classes help students learn how to use technology in pedagogically sound ways.

The tools for teaching with technology are constantly and rapidly changing. Preservice teachers need to experience a variety of tools appropriate for their content an develop a sense of efficacy and confidence in using such tools.  Hofer and Harris (2009) are leading a collaborative effort to match curriculum activities with a set of technologies that best support various types of learning.  (See their Activity Types Wiki at http://activitytypes.wmwikis.net.)  Preservice teachers should also be guided to explore an online professional learning network (PLN), such as The English Companion or National Council for Social Studies, where new resources are often introduced and experiences shared with other educational professionals.  While the learning curve may appear somewhat complicated, preservice teachers can be encouraged to consider the personal ways they use technology as potential instructional tools.  For example, Liz Kolb (2008) has become a strong advocate for using cell phones, normally considered contraband, in the classroom.  Since these devices are often owned by students they can be a cost effective way to use technology and engage students in learning.  Using texting for quizzes or to provide teacher feedback can be one way for teachers to determine the success of a lesson without the need to correct and return papers losing valuable instructional knowledge and fostering misconceptions as student retain incorrect information.  While new technology tools appear almost overnight, preservice teachers should be encouraged to explore these new options while being skilled enough to judge their usefulness in the classroom.

Changing one's practice does not occur overnight, especially, when a new set of skills are required to begin the process of change. This becomes challenging for experienced teachers and teacher educators like Janine. The logical next step may be taking a critical look at the role of professional development to help teachers like Janine. Should technology related professional development look like professional development for other reforms? We would do well to explore the differences.

# Chapter 3
## From Whence Cometh My Help: A Case of Professional Development

In order to prepare today's students with the challenges of the 21st century

workplace, the nation's teachers need to create technology rich learning environments.

Many of these teachers, however, still find ways to include technology foreign,

bewildering, and complicated. This chapter explores how ordinary classroom teachers,

well into their careers, coped with the difficulty of learning to infuse their practice with

new and innovative tools, commonly known as technology. These teachers, all with over

fifteen years of classroom experience, realized they still have many years to work with

today's digital natives (2004). Their students for the most part were comfortable with

technology. As their teachers, in contrast, they were not. The teachers found much of

this rapidly changing world of innovation mystifying and a bit frightening. This study,

qualitative in nature, uses a narrative format to examine some of the issues and concerns

teachers faced to move their practice into the 21st century for the sake of their students'

achievement.

### *Beginning the Search for Answers*

The purpose of this study is to help teachers, administrators, and policy makers

better understand the relationship between experienced teachers and the professional

development they receive in order to increase the skills needed to create and sustain

technology rich classrooms. This study seeks to answer three questions related to

professional development as a source for teacher learning and changes in practice.

- What were typical general and technology related professional development experiences of veteran teachers?

- How did experienced teachers use technology in their personal and professional lives before and after an extend technology related professional development event?
- What kinds of support systems were identified by experienced teachers as necessary for sustainability and enhancement of their technology skills?

This chapter is organized by first providing a look at relevant research literature followed by background to establish the context in which the cases were established. Then, the data are interpreted using the format described in Chapter One where theory-building structure is used on individual cases and continues with a cross case analysis for drawing conclusions and generalizations. Finally, implications and recommendations are discussed.

### *Other Artist's Perspective*

In 1993, Hadley and Sheingold studied teachers skilled in using computers in the classroom and reported that these skilled teachers took approximately five years to effectively and flexibly integrate technology. Each teacher in the study was an experienced user of computers, the technology of the day, yet each introduced and attempted to integrate technology differently into their practice. Hadley and Sheingold concluded that a willingness to change and to learn was at the heart of the process

The process for acquiring the necessary technology skills and efficacy is balanced by many of the persistent barriers that plague classroom teachers. Lack of equipment, time for learning, time for preparation, and adequate support for increasing and sustaining skills have long been barriers to fluency (Ertmer, 1999). Getting teachers to understand what it means to integrate technology with content rather than technology for the sake of technology has been an ongoing task for educational technology advocates. Removing the tendency to make teachers technicians who target hardware issues and excel at

trouble shooting has led to an evolution focused on helping teachers cope with instructional issues (Sandholtz and Reilly, 2004). Today, the need for technological knowledge is added to Shulman's (1987) tenets of teachers' need for pedagogical content knowledge (PCK) creating a new acronym for, technological pedagogical and content knowledge or TPACK (Koelher and Mishra, 2002, 2009). Understanding that today's students can not meet the requirements of the workplace or academia without these skills, these writers emphasize the need for knowledge of technology to be a part of every teacher's repertoire. Multiliteracies and multimodal learning experiences (Anstey and Bull, 2007) require a new kind of teacher who recognizes when and what technology is appropriate for enhancing and promoting learning of specific content in order to increase student achievement.

Various researchers have attempted to define proficient or fluent skill levels among users of instructional technology. Pierson (2001), for example, categorized teachers using technology as having either adequate or exemplary technology abilities. She noted that those with adequate abilities were fairly comfortable with computers but used them to imitate instructional activities and were beginning to develop strategies for integration. Teachers with exemplary technology skills used computers professionally and personally and spent time experimenting with ways to include technology as part of instruction.

In addition, the International Society for Technology on Education (ISTE; see iste.org) has been active in establishing national technology standards for students, teachers, and administrators. Initially those standards for teachers moved consistently from

- lack of knowledge or awareness (Level 1);
- to skills are for personal use or productivity (Level 2);
- to skills transferred to use with students or more advanced techniques (Level 3);
- to communication and collaboration with colleagues to inform and expand knowledge for self and for others (Level 4).

A good example of these levels in practical use can be found in Doug Johnson's (2002) book, The Indispensable Teacher's Guide to Computer Skills, which is used to support what Hargreaves (2003) calls 'directive training,' or coaching, and professional development.

In 2004, the National Education Technology Plan, or NETP ( See Patrick, 2004) identified teachers as being out of synch with the digital natives in their classrooms. According to preliminary data for the plan, teachers lacked the necessary skills to use technology in the classroom and the nation's students spoke out about the need for teachers who were prepared to add interest and life to their lessons. This survey led to the NETP's call for more technology in the schools. Missing from the plan was the charge to school districts to provide professional development that would increase teachers' fluency and reduce the knowledge gap between them and their students.

Professional development is standard practice for providing K-12 teachers with new skills and strategies for teaching. However, though professional development is supported by the federal government, there is a tendency to "concentrate federal professional development dollars specifically and exclusively to support teachers' subject matter knowledge and mastery of subject-based pedagogy' (Koppich, Toch, and Podgursky, 2000, p. 265). Koppich, et al. further explained that teachers were expected to assist students in reaching high standards. This responsibility would require subject matter knowledge and the pedagogical skills to communicate content effectively to

students. Though this commitment by the federal government was noble, researchers

often note that professional development for teachers often proved to be ineffective.

Professional development was often centralized and determined by district staff with little

input from teachers (Little, 1992). As Little observed

> Compared to the complexity and immediacy of classroom demands (and
> rewards), professional development is often a remarkably low-intensity enterprise.
> It occupies little of teachers' time, squeezed along the margins of teachers'
> ordinary work. It requires little of teachers by way of intellectual struggle or
> emotional commitment. It takes only the most superficial account of teachers'
> histories or present circumstances. Teachers' motivation to learn is further
> dampened and their opportunity to learn further constrained by the present
> organization of roles (the separation of teachers from specialists) and by the
> organization of time scheduled to align with programmatic exigencies rather than
> with the ebb and flow of teachers' lives in schools. (p. 178)

Research literature is filled with challenges and solutions related to implementing

technology in a teacher's practice and the curriculum. Barriers to overcome still exist

that include training, support, and time for practice (Ertmer, 1999). Some researchers

linked teachers' belief in the effectiveness of technology to enhance student learning as

being instrumental in changing their practice to include the use of technology (Ertmer,

2005; Frank, Zhao, and Borman, 2004). Sandholtz and Reilly (2004) suggested designs

for technology related professional development needed to avoid creating technicians and

to develop instead teachers skilled in selecting appropriate technology tools for

instruction. Numerous ideas about how best to provide teachers with the technological

knowledge they need through professional development have also been introduced

(Burns, 2002; Kanaya, Light, and Culp, 2005; See also http://Intel.org/education and

http://eMINTS.org).

More than ten years later the teachers in these cases expressed some of the same

concerns elucidated by Little. Even with the call for teachers to acknowledge and present

students with information age skills (Hargreaves, 2003), little had changed in the way professional development was implemented in their district. The teachers found even less emphasis on technology related skills in their professional development offerings.

The teachers in the cases that follow have not escaped being affected or influenced by these challenges and attempts at solutions. Their stories provide insight into the struggles, some of their own making and some out of their control, which they faced and continue to face as they prepare to add an elusive and rapidly changing contrivance known as technology into their practice. Much of what they achieved was outside of the boundaries of their district. Support from administrators was inconsistent or non-existent. These teachers made personal, individual decisions to empower themselves by taking responsibility for their own learning. There is nothing profound about these teachers. These are ordinary classroom teachers. They are not super award winning teachers though some are leaders in their district and in their communities in various capacities. All are dedicated to their students and try to make learning exciting and motivating while trying to increase student achievement. They want their students to have a variety of opportunities for learning and view technology as a way to level the playing field.

### *Making the Most of Professional Development*

Teachers have their own ideas about professional development. Most of them have an expectation that when an inservice is over, they will return to their classrooms with new and improved skills and the belief that increased student achievement is sure to follow. Their expectations are consistent with professional development literature that

offers guidelines and recommendations for how effective professional development should be designed.

For example, active learning that is inquiry based is one element of effective professional development design. Teachers, like their students, need to be actively involved in their own learning (Borko, 2004; Garet et al., 2001, Little, 1993). Complaints of 'sit and get' style professional development with 'experts' abounds in the literature (Little, 1993; Hawley & Valli, 1999). Teachers seem to be better learners when constructivist theories of learning are the foundation of their professional development experiences. Teachers like students need learning options that allow them to construct knowledge. This construction of knowledge can be achieved by "solving real problems through asking and refining questions, designing and conducting investigations, gathering, analyzing, and interpreting information and data, drawing conclusions, and reporting findings" (Fishman et al., 2003). Like their students, teachers learn by doing, especially when learning tasks are technology related. McCrory (2006) suggests that teacher be given time to 'play' or experiment with technology at their own pace in order to understand what a particular technology can do, how it works, and what benefits it will bring to their content.

This 'play' or practice is a necessary part of professional development and teachers need frequent opportunities to use new ideas both in and outside of their classrooms. Little (1993) advocated for opportunities to practice new ideas as a part of the professional development design. She noted that teachers needed adequate time for experimenting, consulting, or investigating "embedded in the routine organization of teachers' work day and work year (p 133)." We know that classroom instruction is

designed to give students numerous chances to practice, review, and reinforces the skills we teach. Teachers as learners have these same needs especially when the professional development is technology related. Effective professional development includes instances where teachers return to classrooms to practice new skills and participate in some form of continuing inservice that allows them to revisit their experiences in discussions with colleagues (Davis, 2002; Hawley & Valli, 1999).

This need for continuous practice introduces the issue of time for learning. Teachers need time to practice both inside and outside the boundaries of formal professional development activities. Researchers have found the duration of a professional development event influences the degree to which teachers find professional development effective and contributes to the potential for changing teacher practice (Garet et al, 2001; Desimone et al., 2002). Brief after school workshops, consultant or experts for a day, and one shot events often are seen as inadequate for providing the time required to increase the levels of skill desired by teachers or those who secure professional development (Davis, 2002, Fishman et al., 2003; King & Newmann, 2000). Creating change takes time if beliefs and practices are to be altered (Loucks- Horsley et al., 1999). Hadley and Sheingold (1993) found teachers skilled in the personal use of technology needed approximately five years to become effective integrators of technology. Consequently, if we are to believe these researchers, during this five year period of learning teachers will require time to practice and explore new tools and new uses for technology within the scope of their content area. Researchers also noted that professional development which is sustained and intensive is more likely to have a positive impact than shorter duration professional development events (Garet et al., 2001;

Hawley & Valli, 1999).  Sustainability could come in the form of learning communities either face to face or virtual via the Internet.

The role of collaboration and collegiality has been a constant among researchers of professional development either during the actual inservice or as an approach for ongoing support.  Collaboration, according to Floden and Bell (2006), "is as important in professional development as it is in classroom learning.  Teachers need to break deeply engrained habits of isolated work and perceptions of professional development as a source of tips and resources for individual use (p. 188)."  Teachers need the support of their peers where there is an opportunity to share, and learn from professional discourse (Davis, 2003; Hawley & Valli, 1999, Hill, 2004; Little, 1993; Loucks- Horsley et al, 1999).  Collegial activities should be designed to create a variety of interactions where teachers convene, for example, with other content teachers or other grade level teachers.  While professional development may be intended for or focused on a specific set of teachers – such as math teachers or science teachers – opportunities should exist where teachers are less isolated and distant from their colleagues despite the physical boundaries inherent in most school buildings.  As reported in Wilson and Berne (1999), CGI (Cognitive Guided Instruction) researchers "found that every teacher talked of the need for community.  For some, the communities were within their schools; for others, the boundaries of communities transcended school walls (p. 183)."  King and Newmann (2000) viewed this idea of communities and collaborative efforts as ways to strengthen school capacity.  In other words, teachers worked together to insure the goals and objectives of their school were met and advanced collectively rather than by a select few.

Content focused professional development is also an important part to the design of effective professional development. Teachers want to enhance skills that can be used to transform their students. Even when technology related professional development is the target, such inservice should be grounded in how technology can be used to support the learning of a particular content area. "Teacher learning is most likely to occur when teachers can concentrate on instruction and student outcomes in the specific contexts in which they teach (King & Newmann, 2000, p. 576)." Garet et al. (2001) also found that when a greater focus on content was emphasized, teachers were more likely to demonstrate enhanced knowledge and skills. Even when the focus of professional development is technology related, teachers still need to determine how new technologies best fit their content (Hughes, 2003). Burns (2002) worked with teachers within the parameters of context and content to increase technological knowledge by combining technology skills in a classroom environment using authentic projects related to their content. McCrory (2006) recommended that teachers develop "a portfolio of technologies that actually work in their unique contexts (p. 157)." The significance of content knowledge incorporated with other forms of teacher knowledge as described by Shulman (1987) can be found in the work of Hofer and Harris (2009) and Koehler and Mishra (2005). Both sets of researchers have begun a collaborative effort to develop TPACK or Technological Pedagogical And Content Knowledge. This new set of teacher knowledge pairs technological knowledge with both content and pedagogical knowledge. Teachers must be able to instruct with technology and use technology within the realms of their teaching responsibilities such as lesson preparation and data management. Technology related professional development that focuses on ways in which technology

can support student learning in a particular content area is more relevant and meaningful to teachers.

The last characteristic of effective professional development targets ongoing support after the initial, formal professional development offering has ended. Continued support and follow up with commitments for coaching, mentoring, or additional guidance (Guskey, 1986) are the mark of effective professional development. When technology is the focus for professional development, success is more likely when social support is present (Frank et al., 2004; Hughes et al., 2005). Even some form of just-in-time assistance can be beneficial to teachers when technology related professional development officially ends (Zhao et al., 2006). Teachers also benefit when colleagues are able to provide assistance when problems arise (Frank et al., 2004). When Sugar and Wilson (2005) studied ways to provide alternative technology related professional development to inservice teachers, they found that 95% of the respondents wished to have someone in the classroom to help with specific technology needs. According to McCrory (2006), relying on others to introduce technology resources is "the best way to make decisions" (p.157) about new technologies. Teachers need onsite technology mentors and to be "able to team up with technology experts. ... [to] see firsthand how they can use technology in their classrooms and how to negotiate its use with students (Zhao et al., 2006, p. 173)."

In the case studies that follow veteran teachers share experiences and challenges associated with becoming more fluent in using instructional technology. After participating in a technology related professional development event, they express their

appreciation for and, occasionally, frustration with some of these characteristics of effective professional development they encountered.

## *Background*

The precursor for this study was an inservice using the Intel Teach to the Future: Essential Question course. Intel's method of teaching technology skills to educators evolved around the formation of a strong instructional unit plan that was infused with suitable technology components. A 'train the trainer' model was used in the forty hours of instruction which included collaborative planning, group discussions, and feedback from practice opportunities. The situative learning (Borko, 2004), where social engagement is part of the learning environment, format allowed teachers to learn as much from each other as from the facilitators or workshop leaders.

Teachers came together for a technology learning experience offered by their district for the first time. Some of them would participate in a subsequent session of Intel training not because they 'didn't get it' the first time but because the design of the program was what they needed as a catalyst for changing the way they would teach. This training provided more than the standard after school two hour 'sit and get' workshops typically offered for software application training which often had limited relevance to their content area.

The district provided each classroom with at least one desktop computer and participated in a state wide program to provide a personal piece of technology for each teacher. The teachers in this study came from two middle schools and both schools had selected an option to receive a laptop computer for each classroom teacher regardless of content area or grade level. Support staff such as counselors and media specialists also

received equipment. At the time of the classroom and laptop initiatives, few teachers in the district were computer literate or fluent enough in technology to adequately include technology in their instruction. Each middle school also offered students a computer class with a dedicated computer or technology teacher. This elective course meant students had an opportunity to learn how to use computers outside of their content areas. Ironically, most middle school students had more opportunities to become fluent technology users than did their teachers.

The author served as primary facilitator for this forty hour inservice which was held after school and on some Saturdays over a period of approximately ten (10) weeks. While Intel recommends that participants in this program have technology skills beyond the novice stage, most of the participants came with minimal technology skills. They agreed to participate because of their limited skills and the insufficient technology related professional development offered by the district. The goal of the program was to assist teachers in the integration of technology into their content with the potential to increase student achievement and not merely to provide disjointed technical skills.

Surprisingly, the participants were seasoned or veteran teachers with at least fifteen (15) years of classroom experience. While Huberman (1993) might view these teachers at the disenchantment stage in the teacher life cycle as they moved toward the end of their careers, their commitment to learning new skills is more reflective of teachers in the recreation or reform cycle (Huberman, 1993), ready for change and a sense of adventure. Steffy, Wolfe, Pasch, and Enz (2000) would categorize the teachers in this group as expert and distinguished teachers within the life cycle of the career

teacher. These teachers saw technology as a way to re-create or rejuvenate their careers while exploring ways to boost student achievement.

The purpose of this study was to gain knowledge from veteran teachers about the significance of professional development; how they used technology before and after the inservice; and their perceptions on how their efforts needed to be supported for sustaining what they learned. Gaining an understanding of these three areas would give hope to other struggling experienced teachers and help administrators and policy makers understand how better to assist veteran teachers in technology reform efforts.

### *Selecting the Portraitist's Tools*

This multi-case study is comprised of six mini-inquiries from veteran or experienced teachers who, after avoiding or evading the use of technology in their professional and often their personal lives, came to the realization that technology in education was becoming an important part of student learning and a viable way to promote or enhance student achievement. The teachers, well into their teacher life cycle (Huberman, 1993), realized they were not keeping abreast of the growing methods for motivating, exciting, stimulating, and inspiring a new kind of learner. The plethora of information available on the internet, the ease of communicating and collaborating with a distant peer, and the potential to acquire knowledge anywhere at anytime was altering the way teachers had taught in the past. A new type of classroom was evolving with a new kind of teacher and the teachers in this study refused to be left behind and out of touch.

Teachers in these cases are representative of a larger group of teachers who had agreed to participate in Intel's extensive professional development course for technology integration in the fall of 2004. The prerequisites for subjects in this study were the

participation in this course and the status as an experienced teacher with at least 15 years in a classroom. Before this study could be initiated, most of the initial participants would elect to retire. Of the original seventeen (17) only six (6) of those remaining would meet the research focus of veteran teachers and agree to participate in the study. These remaining teachers planned to continue teaching for several more years. Their lack of fluency in technology was no longer acceptable to them as educators and they identified themselves as inadequately prepared to integrate technology into their classrooms, curriculums, or their practice. They made the personal and professional decision to change their existing practice by including some of the tools their students were already using in their personal lives.

Six of the original seventeen, all middle school teachers, were available for interviews. Of the six, three were from Yardley Middle School and three were from Central Middle School. The schools, not the actual names, are located in a middle city size community of a Midwestern state in what would be defined as an urban district due to the high numbers of At-Risks students based on free and reduced lunch participation. Content area specializations included English Language Arts, Social Studies, Special Education, and elective or non-core subject matter. These research subjects were not selected randomly but confined to those who met three (3) criteria: 1) they had participated in the particular forty hour technology related professional development; 2) they were fifteen year plus veteran teachers; and 3) they consented to being interviewed.

Yardley and Central offered two similar yet different technology environments. A district mandate provided all classrooms with one PC with Internet connectivity which teachers viewed as reserved for daily attendance and quarterly grading. Each classroom

had connectivity access for five (5) student stations though no additional student equipment was provided. Student access was limited and the PC was not viewed as an integral part of the instructional program. Both schools had a technology or media center and at least one instructional technology lab where students were scheduled for a course in applications in technology and keyboarding. Central's technology center was a high tech environment while Yardley's center consisted primarily of computers, printers, and a scanner. While the instructional lab was not viewed as available to teachers, the technology or media center at both schools was in great demand, often by the same few core teachers, primarily for Internet research. Teachers in this study had varying success securing the technology or media center for their classes, especially at Central.

Ninety minute semi-structured interviews consisting of nineteen (19) questions (See Appendix A for interview protocol) with the six remaining middle school teacher participants were conducted from January of 2005 through late spring of the same year. Interviews were delayed due to scheduling difficulties of both the teachers and the researcher. Based on the informants' response, various probes were used to elicit more details appropriate to an individual's skill level and amount of technology used in classrooms before and after the professional development event.

### Exploring the Artist's Palette

The interview protocol focused on three categories or families of study,

- The subject's experiences with professional development both technology related and professional development in general;
- The subject's use of technology for professional and personal use both before and after the inservice;
- The subject's perceptions about the support systems that were in place and how these systems might aid in sustaining their technology skills.

Interviews were audio recorded and transcribed in detail by the researcher

creating six separate files. From the transcription, efforts were made to match each

subject's commentary with the three families of study. After several iterative reviews of

the transcripts and the audiotapes, the data were analyzed revealing four areas noteworthy

for inclusion in the study. A coding system was developed based on the following four

major areas of study:

- teachers' use of technology before and after inservice;
- causes for reluctance to use technology;
- teachers' view of professional development;
- and teachers' view of support for sustaining technology skills.

Numbers used at the end of transcription quotes indicate a paragraph within the

individual file for the designated teacher. The data was analyzed not so much to identify

patterns and trends but rather in an effort to extract significant perceptions from the

standpoint of the teachers interviewed. The data would be used to narrate the views of a

small but representative group of experienced teachers and their efforts to become fluent

in technology.

The findings section, Thematic Revelations, is constructed using theory building

structures (Yin, 2003) to explore the four area of concentration. The discussion section,

Reflections across Cases, uses cross case analysis (Yin, 2003) to expound upon any

patterns, trends, consistencies or inconsistencies in the data based on the interpretation of

the teachers' perceptions.

### *Introducing the Participants*

The following demographic information for the six study participants has been

deliberately generalized to provide confidentiality. The names used in the study are

pseudonyms as are the schools as previously noted. All other information is factual but

not specific to individual teachers. The teachers were not asked to share their ages and those with the most classroom experience are not necessarily the oldest. Conversely, the least experienced teachers are not the youngest. The group is comprised of six female teachers. Two are Caucasian and four are African American.

Cathy, Fiona, Zina, Tonya, Norma, and Olivia have been teaching for 31, 16, 24, 31, 28, and 16 years respectively. There were two Social Science teachers, two teachers who were part of the Special Education department; one elective teacher, and one Language Arts teacher. While all taught in middle school buildings, one met with elementary students and none of the group taught seventh grade students. To offer a perspective on the age of the teachers, I note that only two teachers in the group had school age children at home.

Each member of the group had varying extracurricular duties or responsibilities within the district. One acted as a facilitator for many of the district's scheduled professional development events. Another sponsored three after school programs for community service and academically inclined students. One teacher tutored students after school and there was a department chair in the group. One member of the group came to the classroom after many years of working in the private sector. Each had varied interests, teaching styles, and backgrounds.

### Thematic Revelations

### Initial Teacher Technology Use – Pre Training

Prior to participation in the Intel program, most of the teachers were not users of technology either personally or professionally though some had made attempts. Tonya as an elementary teacher had a computer in her classroom and would arrange for students to

have computer time each week to use a reading program. Her move to middle school could be viewed as a set back since for several years she had no computer in her classroom. At the time of the interview she had one computer she categorized as 'the teacher's computer.' It was used primarily for reporting daily attendance and during the grading cycles throughout the year. She also accessed the district email system to get communications from the principal.

Surprisingly, Tonya had two desktop PCs and a laptop at home which she readily admitted to not using. Her home email account may have been suspended since she stated it had not been used during the past school year. Tonya explained her lack of use this way:

> When my son was younger I used it quite a bit because I would get programs for him and I would go through the programs with him. And so I did. But my son is now twenty so since middle school he basically hasn't needed me. When I needed to have something done on the computer at home he was there to do it. (100)

Getting Tonya to recognize or acknowledge any use of technology in her classroom was difficult. This was not unusual for many of the subjects. Either what they used had become 'natural' in their classroom or they did not think of it as using technology. The following interview excerpt is an example –

> Sandra: Are there some ways that you use technology with your students that are specifically designed to enhance student learning?
> Tonya: No. I don't think so.
> Sandra: Well, then you probably want to include your PowerPoint.
> Tonya: Yes, the PowerPoint.
> Sandra: So once they do PowerPoint then the technology is nonexistent in your classroom? I don't want to put words in your mouth.
> Tonya: I have done some things like on the overhead from things that I've printed out from online. Things like that. For example, I did a newspaper scavenger hunt. I went online and found several and did one for the kids because we do do current events once a week. And I wanted to do something different. So I did go and print one out and make an overhead

and we use that. And I have gone and gotten pieces and used it as an overhead tool to present.

Sandra: It sounds like you use the Internet to do some research on your own to find things that you can then take and use with your students. So that is using the technology?

Tonya: Yes, doing some research. (126 – 131, 134, 135)

Prior to participating in the professional development event, Cathy would probably have been identified as a non-user of computers. The extent of her personal use was minimal, but she noted, "Unfortunately every time you go someplace and you have to do a shower everybody's got their little stuff online or on the computer. So you have to have some basic knowledge of it (72)." She had some experience with online shopping but was apprehensive about providing personal information online. Other than the required daily attendance and use of an electronic grade book, Cathy did not use technology for instruction, support of instruction, or student learning.

Norma, on the other hand, made a few attempts to use of the technology available to her. Students were allowed to use the 'teacher computer' to look things up on the internet. As a Special Education teacher, she would also use her word processing software to revise worksheets for her students when she felt the amount of text presented would overwhelm them. More telling is her hesitancy even after attending several summer institute workshops involving technology.

> There was not a big emphasis during the time that I was taking those workshops on integrating technology in the classroom. Plus I was not … I just didn't feel like I have enough technology skills to come in and tell the students we're going to do this today. So what I did, I took the workshop, I learned how to operate the computer to do the basic things that I needed to do, like the attendance, the grades or this kind of thing. But as far as using it to teach students something or use it to evaluate them using it, because that's what the evaluation is for, the PowerPoint. I would not have used anything like that to work with my students as far as trying to do anything different. (56)

Norma's insecurity stood in the way of her moving forward. As a Special

Education teacher her concern was also with not wishing to do harm to her students.

> And then I looked at the students that I work with. These students have a learning
> disability or have some kind of problem. So my thing was this: why would I make
> a mistake with them when they already have a problem and I didn't understand
> what I was doing myself. So if I was not comfortable with teaching tools, I did
> not use them. It may have some kind of aftereffect with the students, more
> negative than positive. (58)

Fiona used technology or her computer primarily for 'typing.' As a graduate

student, she also used it to prepare papers for her courses. Occasionally the computer

might be used to prepare a quiz or worksheet for her students.

Two constants appear in conversations with all the teachers. First, the one

computer in the classroom is the sole property of the teacher. These computers were

generally placed close to teachers' desks to be within easy reach. This location in the

classroom meant less accessibility for students and sent perhaps subtle messages that

students were not free to use the equipment. Teachers lived in constant fear that students

would 'mess something up' or 'students would break something' leaving them without

the necessary tool for their daily attendance reporting. They did not want to be

inconvenienced by having to wait for planning time or after school to go to the media

centers in order to use a computer. Some felt strongly that if the hourly reporting of

attendance was required, equipment in good working order should be available to them at

all times in their classrooms.

Second, all teachers worked in schools that participated in the state's laptop

initiative program. This program provided each teacher with a laptop for their use. The

laptops seldom found their way into classrooms and were seldom used either inside or

outside the classroom. One teacher noted, "Matter of fact, the battery went out on my

computer and I was talking to someone and they said 'you can use mine' and their laptop had never been taken out the box. So they brought theirs over and we were using theirs until we got another battery (Tonya, 108)." For these teachers, having the laptops available did not guarantee that the quantity or the use of technology would increase inside or outside the classroom. Teachers in this study never mentioned bringing the laptop to school to provide an additional computer to their classroom although most said using technology meant they needed more equipment.

### *Teacher Perspective on Professional Development in General*

Teachers were asked to describe their professional development experiences in order to elicit two kinds of data. One, the question was formulated to retrieve prior professional development events that had positive or negative outcomes. Second, the question was designed to extract feedback on the personal effectiveness of the Intel inservice. A conscious decision was made to create a question that would elicit feedback indirectly to avoid overt bias since the researcher and the facilitator were one and the same. Teachers would, hopefully, describe positive outcomes without being asked to assess the training directly, especially since this was not the primary objective of the study.

Teachers expressed disappointment with the current methods of providing professional development much like reported in the literature. Decisions were made at the district level with little input from teachers. In previous years, more days had been set aside for professional development and an automated menu system was used for selecting sessions. In retrospect, much of the professional development was viewed as inadequate and very little technology related professional development was available.

Another objective was to compare the current technology related professional development with previous experiences. An important question was - How did this experience compare to other similar professional development events?

Despite the privilege of choice, Cathy noted that the latest offerings were not impressive and limited obliging her to base her decisions on location first and then content. Since sessions were being housed in her building, Cathy selected something that would allow her to remain all day at her normal work site to attend, "Creative Movement." On PD days teachers, unless mandated to attend specific content workshops, met for part of the day within their own buildings. She explained her choice as follows:

> So they will give you a list of different classes that they offer and that would happen to be, number one, it was here in the building and I didn't have to travel and secondly, truly, there was nothing else on the screen. You know, they have math things. You know, they had science things. (26)

As a social science teacher she saw basically nothing related to her content either in her building or any of the other sites where sessions were held.

Overall, as a veteran teacher with almost thirty years in the classroom, Cathy is not particularly 'picky' about the kinds of professional development exposure she has encountered.

> I feel that anything that I'd take, if it's not beneficial I can't use it in my classroom; you've wasted my time; you wasted my day. If there's something out there that you wanted me to learn or I wanted to learn that I can bring back in here, then it's beneficial. (32)

When she leaves a professional development event, she expects to leave with something useful and meaningful to use with her students. Creative Movement was not one she viewed as a meaningful professional development offering.

In previous years, Cathy attended technology focused summer institutes but she did not recall them without some prodding. She found the Intel offering most beneficial because "The way the last one that I did with the Intel with the different modules, it was on-going. Somebody would follow-up afterwards, well, how are things going? That helps (46)." She continued

> Having assignments, okay, can you use this in the classroom and you come back, you share - what did you do? Being able to share things that you've done and being able to hear other students in the classroom tell about their success, but also being comfortable telling about the failures, too. (48)

Norma's view of professional development was more student-focused. She deliberately selected a writing workshop because elementary students would come to her in the middle school with a certain set of skills and she wanted to expand on those skills. In order to do this, she would have to understand the pedagogy used to teach this writing program. Unfortunately the inservice failed to meet her expectations. "But I felt like the program was not dealt with in depth well enough for me to get to use what I need out of the program (32)." She continued "Because they said it's a three day workshop. But you cannot give me that three day workshop to me in, I believe, two and a half hours (26)."

Norma was the only teacher who identified workshop leadership as the main reason for attending the Intel program. Social capital influenced her decision according the following comment about one of the facilitators.

> Norma: I always thought that she had a very simple way of teaching us to understand what the computer is all about and what things you can do with it. So that's what influenced me.
> Sandra: If she had not been teaching it would you still have taken it?
> Norma: Probably not. (42 – 44)

The Intel program was successful for Norma because she gained email skills, managed to learn more about the technology available in her building and began to understand how to develop plans for how she would use technology with her students.

Fiona's reasons for initially participating in the Intel program were similar to Cathy and Norma – location and the workshop leadership.

> It was very convenient. It was two doors away from me. The hours were fine, after school. I didn't have any activities going on. It met once a week. That was fine. Some Saturdays. So all of that played into working around the family. Mainly that. And then, you know, coworkers saying 'let's take this. Let's try it'. And, of course, the people that were teaching it as well. (64)

Since the Intel program was not a required inservice, teachers could elect to attend. All, including the facilitators, did so without district supported stipends. The program required a significant time commitment for both classroom and time for 'homework.'

One teacher, an experienced sought after facilitator, noted her need to be on stage often hampered her ability to participate in any technology related professional development. Zina was very clear on the distinctions between providing professional development and being on the receiving end.

> The thing that I find as a trainer is that when you go to a training, you taste and when you become a trainer, every time I get ready for a session, I learn more. So as I present, I am also being professionally developed because I see new, more things or I practice more in my classroom and then I can bring that to my training and I see the connections. It isn't that I am never being professionally developed but it does limit the boundaries of that professional development and I am not hearing from people. I'm getting it off the written page and my own experience and then whatever feedback teachers in the class give me, but I am not. What I would really like to do is sit at the feet of a master and listen. (40)

> And that's where I am. And what I'm finding with professional development is they're all people like me. They have the rudiments of knowledge and they can offer you on a certain level. But really I am hungry for in depth thinking about our profession globally, not just a piece of what goes on into being a teacher, but to

think about the profession, the craft, the philosophy, the way we impact our culture. I would really like to have more of that. (42)

Lack of choice was perhaps the biggest complaint. Teachers knew what they wanted to explore ways to change their existing practice, but the opportunity to make those choices through their district was not presented. District decisions were limited and focused on content to support state high stakes testing. The underlying fallacy seemed to be that technology could not be a part of this process.

### Technology Related Professional Development

One goal of this study was to identify where technology fit into the professional development teachers were receiving or teachers wished to receive. Teachers were asked to describe some recent professional development events and to note those that were the most and the least beneficial. What surfaced from their conversations was the lack of meaningful professional development related to technology and often to their content. In previous years the district had offered several 'how to' technology workshops. Few could remember the content or the software application used but admitted to attending various sessions over a period of years. They discussed returning to classrooms without clear pictures of what to do - the mechanics – or how to fit what they had learned into their content. In essence, these 'out of context' professional development offerings did little to provide a greater sense of efficacy or increase confidence. Reflectively, they considered these experiences as ineffective and of little value.

Frustrated by the lack of technology related professional development available on designated PD days, some of the teachers went outside of the district to acquire the basics.

Fiona: I, you know, as well many others, sat on the fence waiting for this technology, waiting for this technology to go away and then it did not and so I thought, well, I needed to do something or I am going to get left out. So I started off taking classes at [local community college]. Introduction to Computer Systems. I also took An Introduction to the Internet. (14)

When the subjects offered so few examples of technology related professional development in their overall examples of professional development, a probing question was included to determine if technology was introduced or discussed during content meetings. One would imagine that the use of technology in science or social studies or special education would be a topic for discussion when content area teachers gathered to discuss curriculum issues. Each teacher indicated that technology was not a topic of discussion during content area meetings on professional development days or formal gatherings. Here is a portion of one interview to demonstrate as much:

Sandra: When you communicate with other Special Ed people. When you guys are at meetings or whatnot, do they talk about using technology in your classrooms? [No.] So there's no shared information about that. So if it's being done you're not privileged to it for whatever reason because no one thinks that it's important?
Norma: I feel like they think now that everybody has a really good understanding of technology, how to integrate it in the classroom so no one is really saying. What they are sharing now is best practices. What you can do to enhance student learning. I think those are the kinds of things that they are sharing here. I don't know about any other schools, but here that's what I hear. (63-64)

Norma's response reflected a personal sense of how others in her area responded to technology. It was unclear why she felt this or why best practices did not include some form of technology.

Another teacher responded this way:

Sandra: So I would ask when the [Program] people get together do they not talk about how they can use technology or offer suggestions. I would expect—let me tell you about this new program. Let me tell you about this.

> Zina: We don't. Only one of us has a lot of computers accessible to the kids. For us it's more [Program] issues not technology issues. [Program] is the selection, nomination, testing, strategies for teaching. (126 – 127)

Zina seemed to waver a little at the end of her comments as if realizing that discussing teaching strategies could or should include an element of technology. When we consider the effectiveness of collaboration on teacher learning (Davis, 2003; Floden & Bell, 2006, Hawley & Valli, 1999), the missed opportunities these teachers describe for increasing technological knowledge are unfortunate at best.

One teacher found a way to work on her technology skills while providing a technology experience for her students. Tonya talked about her 'in house' professional development experience when she took her class to the media center to work with the media specialist on a PowerPoint project.

> Tonya: Basically I took my classes to the media center and she did several things with my students. We did PowerPoint presentations so she did lessons with them and we went like for two weeks.
> Sandra: So you would take your class to the library and the media specialist would do the training? Did you sit and work as if you were one of the children?
> Tonya: For the first couple of classes I did. Then I wanted to see if I could do it on my own and then for a couple of classes I would just take the lead and just holler for her when I got a little stuck. So basically I took over. I just wanted to see if I could do it. (18 – 20)

### The Influence of 'Fear' on Learning to be Technologically Fluent

Fear was a common thread for explaining the avoidance of using technology in the classroom and often for personal use. Although some of the teachers used the words fear, scared or afraid, the underlying meaning was not consistent. Regardless of how they chose to express this feeling, being somehow frightened or anxious when it came to using or learning about technology was not an uncommon occurrence.

Cathy's biggest fear was pressing the wrong key or button and losing all her

work. She felt a keen sense of responsibility for the safe keeping of any data in her care.

Early in the interview she recounts, "Because I was just totally terrified to even bother

with the computer. I feel if I touched something it would all disappear and be gone

forever." (28) Later she explains more about this idea of 'fear' when using computers.

> Even when I was doing the Grade Quick, I still had to put them on paper because I had this fear that if something happens to this everything is gone and lost forever. And nine times out of ten I'm more afraid that it would be my stupidity and that I would click the wrong thing and poof it's all gone. (64)

Later after the Intel program, she spoke about a lessening of her fear stating, "Since I now

know how to help to guide them [*her students*] and some of them are guiding me and

showing me some things on the computer, I'm not afraid of it the way I used to be." (62)

Olivia's fear is tied to her initial state of avoidance when it came to even thinking

about using technology. She explained,

> … there have been many other things offered that I did not even bother with because…there was a time, there was a time when I was … when I was very closed minded to technology and felt that I was so far behind that it was going to be impossible to ever get it, so I was just going to try to leave it alone and hope it would leave me alone. (48, 50)

Through the Intel program she was able to assuage her concerns because "I found among

other things that there were other staff members who had the same reluctance and the

same fears and that with training that we could be taught (54)." What she wanted to do

was to wait out the interest in technology which, in her mind, was destined to fade away

like educational programs often do. However, her inability to work with her students,

among other things, also prompted her to reconsider her thinking.

> Or the first time I was working on a book report with a student and we were in the library and we were on computers and I couldn't help the kid and I realized that I better at least be a step ahead. (60)

While Tonya did not articulate the cause of her fear, she did use the word when explaining why she agreed to participate in the Intel program. The exchange that follows does not tell much about this 'fear' but leaves us to our own interpretation that perhaps the Intel program was a way to get beyond the 'fear.'

> Sandra: My first question is what motivated you to take part in that Intel Teach to the Future?
> Tonya: Really I've always had this kind of fear of computers and I'm notorious for being able to kind of take things apart but when I go to put them back together ... (64 - 65)

Zina's 'fear' is related to the insufficiencies often associated with computers in the classroom.

> ... when computers were first being brought into our classrooms and they were real scary to me, I took a training, but I had no computer in my classroom yet and I had no computer at home. You know, you learn to use some workshop program and that's all well and good but two months later when the computer has finally arrived you don't remember any of it because you haven't had a chance to implement what you've learned. (60)

The lack of access followed by an expectation that she would not know what to do at the appointed time rattled Zina. Her fear manifested itself again when she thought about the unexpected occurring during class time.

> I'm still afraid. I'm afraid I will screw something up really bad. ... I catch on how to navigate the program but if something goes wrong it's what I don't know that scares me. I don't even know how that cotton picking thing works. Excuse me, but how do those letters go through a little infrared beam and onto the screen and then print through a printer. I don't get that. And I don't like not getting it. So if I avoid it, I don't have to confront the fact that I may never understand that part of it. (66)

Zina wanted to understand the workings of the computer and found comfort in the knowing of something. The lack of knowledge was the basis of the fear and a reason for not venturing out to even begin using the technology.

Norma never mentioned the words fear, afraid, or scared in her interview but made the same point it two different ways. First, she rationalized her inexperience with PowerPoint by admitting to lack of courage.

> Norma: I would see it on my computer but I never would push the button to turn it on.
> Sandra: You weren't brave enough?
> Norma: No, I wasn't brave enough. I'm not in an adventurous person. (53 – 54)

Second, she clearly stated her issue evolved around not knowing enough to be effective.

> Because I'm quite sure that their other teachers, who are doing an excellent job with the technology, and their children are benefiting from it. But I felt like I didn't know enough and that was my whole thing. Not enough. I didn't know. (60)

Perhaps Norma expresses it best. Not knowing what to do or how to do it was more burdensome than actual fear. Not knowing enough, although no teacher could articulate what it meant to know enough, provoked this sense of fear. Knowing more than their students or not knowing all about an application drove many teachers away from educational technology. Until proficiency was established, they were reluctant to begin introducing technology at any level into their classrooms. The dichotomy was that they also did not know how to become proficient. This circuitous state of being resulted in little or no progress and a sense of - why bother?. Until all teachers are given opportunities to learn about technology and how to incorporate technology choices in their practice, options for enhancing student learning though the use of educational technology will remain essentially unfulfilled.

## *Subsequent Teacher Use of Technology – Post Training*

An important question for the study was how teachers' use of technology changed after completion of the professional development event. At the time of the interviews,

almost eighteen months had passed and teachers had ample time to implement the content

from the forty hours of inservice.  During this time teachers could, if they chose to,

continue acquiring skills and increase their comfort level.  Some of the fear could

potentially dissipate allowing for more experimentation in the classroom with students.

None of the teachers reported no change or a continued effort to avoid technology either

personally or professional.  Some did express difficulty implementing what they learned

but did not indicate a lack of interest or a decision not to continue trying to use some

form of technology.

Olivia saw a marked change in her professional use of the internet.  In the

following statement she seems a little surprise at what she was able to accomplish.

> Yeah, one thing I did too was after Intel … was I felt more comfortable going to
> … I spent some time researching for things for a supplement to Anne Frank
> material.  I got kind of almost sidetracked looking at the Danish resistance during
> WWII under NAZI domination and how they helped the Jews and stuff.  So I
> found a lot of … I just the kept going into more web sites and more web sites.  It
> was the first real exploring I have felt comfortable doing on a topic and I almost
> couldn't stop. (112)

Olivia also felt comfortable enough signing up to use a classroom set of hand held

writers, Alpha Smart units, to use during a unit with her students.  Watching her students'

excitement at being able to use the technology and their ease at adjusting to the new tool

convinced her that trying other things might not be as daunting as she had anticipated.

Olivia also began using email more frequently and used Word to join her

colleagues who created "these wonderful handouts that they had generated themselves

and wonderful syllabi and other lovely things (60)."  She was also able to locate

supplementary information for a novel she was teaching and used a collection of websites

from the inservice and for "just plain information on where to go for things that I don't

think even my some of my peers knew about or utilized. There's stuff that I still can tap

just by going through my materials (100)."

Zina's confidence level increased to the point that even shopping for technology

became an event filled with knowledge and certainty. She described her use of

technology after the inservice as "more and varied" (103) and then continued with this

example:

> And that's the other thing Intel did. I own three thumb drives and I bought a hub.
> I saw them on sale at Home Depot and I'm thinking, well, I think I need that. It's
> only $10.00. So I bought a hub. It's not hooked up but I own it. And when I get
> to know how to use it, then I've got it. The other thing I did was at Home Depot
> they had USB cords, three of them for $10.00. I paid 30 bucks for one when I
> first got mine. So I bought those. I mean I knew that was a good deal. So I
> would not have known that before and I also knew when I looked at it and I saw it
> said 2.0 cable. OK, I know that's what I need. (103)

Cathy explained her change in how technology was used after the inservice in

very simple terms.

> I'm using it. Bottom line. I am using it more. I'm using it to do my own records.
> I'm using it to do like you even taught me on the Grade Quick and how you go in
> and do the little message and stuff. I'm venturing out more and doing a little
> more expanding, when it works. (66)

She also explained the changes in how she worked with students using technology.

> Just the mere fact that I am using it more and I'm using it with my students and
> they're doing reports on it and I can take them upstairs to the library and [*media
> center staff*] will help me with my class upstairs. Before I had never taken a class
> up there – period. (68)

It was hard to get a sense of how much Fiona's use of computers had changed. The

changes were subtle rather than blaring. Her attitude on student use of her lone computer

was one example. Prior to the Intel inservice, she seldom allowed students to use the

computer without her direct supervision. After the professional development she allowed

students to search for information knowing that "I feel comfortable enough if they get in

a bind, if they can't figure out the information, I can go over and say let me show you (84)." For some teachers even small changes are important. Fiona was proud of her conversion to a flash drive in lieu of her old floppy disks. She explained,

> ... because, well, you know, the era of the floppy disk. Once I got on board with that showing everybody this little key that can store the same amount information ... Showing my husband how that's obsolete. You can't use that anymore. Oh, you can't use that anymore? ... that's how you store information now. (108, 110, 112)

Later, she stored slides for her classes on the single flash drive where before she has distributed floppy disks to students.

Fiona found the inservice helpful in her subsequent use of a grade book program licensed by the school. She saw first hand how by using technology she could change the presentation of data for communicating with parents. She observed, "it looked so professional. I can't believe how we would carry around our grade books and present this to the public (104)."

### A Question of Sustainability

A final question asked what could be done to be more supportive of the efforts these teachers were making to increase their technology effectiveness. If the 'sit and get' workshops were inadequate and the Intel inservice more beneficial, why had so little change actually taken place? What was it that teachers felt would be the most beneficial for helping them through the complexities of educational technology integration?

As one might expect, teachers wanted more time to practice what they had learned during an inservice. This is consistent with most literature about reform focused professional development. Using unfamiliar technology tools in the classroom required preparation, knowledge, and some degree of efficacy before inclusion. Teachers wanted

time to practice and experiment in order to feel more confident. While teachers felt the Intel program included this time as a part of the course organization, more time was also desired to continue building confidence and efficacy.

Next to the gift of more time, all the teachers in this study wanted a place or a person to go to where they could get answers and help when they needed it. More than one teacher expressed the desire to have someone work with them in their classroom with their students. Cathy, for example, received a data projector for use in her department. The school's audio visual specialist visited her room to connect the device and showed her how to use it. "I've had a lesson on it one time and [he] went so fast on it I was like zip that baby up (136)." This one time event was insufficient leaving her with questions and doubt. "I guess the mere fact that I've had the one lesson and I need more. ... I need feedback. I need someone to ... (140)" Trailing off, Cathy's gestures indicated a sense of frustration and powerlessness.

Olivia's lack of experience allowed her to use her school social network to help her over the rough spots. "Usually at the level I'm at a peer can tell me more than I know. And I haven't yet reached the point where my questions are so great none of my peers can help me with it (150)." However, she goes on to point out that if she were to outgrow her peers, "... if that were to happen I don't know what I'd do. I'm not sure where I would go (150)." At the time of the interview, she was not aware of any resources that would be able to help her answer the tough questions.

Olivia does not expressly mention her knowledgeable network of peers when asked what can be done to support her in her efforts. Her peers included a former technology teacher, a teacher taking educational technology master's courses, and the AV

specialist who was housed in close proximity to her classroom. These colleagues were supportive but she saw her increased progress as a personal, individual endeavor when asked the steps she needed to give her students the opportunities she wanted for them. She could envision achieving her goal by, "Setting the parameters, reserving the computer lab, and going at it and doing a certain amount of winging it (172)."

Zina was especially concerned about finding a resource to help her increase and sustain her skills learned in the Intel program. Isolation was a key factor for her since her program served elementary students but was housed in a secondary building. She did not feel a connection with the teachers around her who were on a different schedule and physically distant from her classroom. She missed the availability of other elementary teachers when "I could holler out the door—and say 'hey, I've got this issue could somebody come down and show me how to do this?' And somebody would come down and show you how to do this (137)." This support from those in close proximity would be more conducive to promoting change because "it takes a lot of effort for me to go find someone and schedule it and make the phone call (137)."

Norma was another teacher who longed for a resource that she could count on to come to her classroom and help her to do things correctly. She relied on the presence to the workshop facilitator to boost her confidence. "But you have confidence when you're with the instructor because you know you have help. But then when you get back in your classroom that confidence sort of zeros out (134)."

Fiona's preference was for more Intel training. For her working with her colleagues was a big plus and getting additional support in the form of manuals and emails was not what she wanted in the way of continuing support. She also wanted to

have a person available "because I do have the book but I like to see people in front of me (224)." Cathy was perhaps the most adamant about having a support or resource person available to help her in her classroom. Initially she indicated she could rely on the media center staff as resources for her questions. "I guess we have resources upstairs that I can use. … because sometimes around here you just have to fly by the seat of your own pants (112)." But she ended her statement with the opposite conclusion. She did not seem to feel there actually was a place to go for her questions. She reiterated the desire for a person to work with her individually during the interview.

> … it would be nice if I had somebody come in to just spend a few hours to guide me through this process or procedure. That would be nice. That would be the kind of inservice that I would like. (114)

> I would like to see the person who is available in the district to say, OK, February 19, I'm assigned to come and work with Cathy's class and this is all we're going to do. I'm going to teach each one of her classes and while I'm teaching she is going to learn from me. I need some role models. (120)

> Somebody who's available for not just me because I'm pretty sure there's someone else out there in the district, in the same boat as I am, but to have someone available to come in. (122)

> I would like to have someone like I said in the district who could come out and spend this the day with Cathy. And this is how you work this. Now let me unplug it and now you do this. (142)

> I would find that beneficial but on the same token the person who's doing that should be able to say well, the district has provided me so many days or each Tuesday and Wednesday so that I can go out into the district. Now I've given you this information would you like for me to come and show you? Would you like for me to come and do some follow up with you? Because like you can be in those workshops and I don't want everybody to know I know next to nothing. I need to be able to feel free to say I don't know; come and help me. (154)

Cathy was the least knowledgeable in the group and within an environment of comfort would share this status with others. For her, one on one instruction with lots of hand

holding was what she felt she needed to gain a greater degree of efficacy and even a modicum of fluency.

### *Reflections across Cases*

One thing became clear after talking to these six teachers. They wanted to understand how to use technology in their classrooms. They were aware that other teachers had begun, at the very least, to use some form of technology. How to accomplish this feat for themselves was the missing part of the puzzle. Each teacher wanted her students to experience using technology even if a goal of increased student achievement was not overtly stated. The teachers in this study gave of their own time outside of contract hours without compensation. They came because we invited them to participate in a forum where they could work with their peers to explore what to them was uncharted territory.

Olivia's excitement came from her students who had no trouble diving right in to her writing project using portable keyboards despite her reluctance. Very purposeful in her determination, Zina had made it a personal goal to improve her skills. She stated rather eloquently,

> It's a goal. That's my professional development goal for myself is to get better. I'm teaching advanced and accelerated kids who really know more about technology than I do and I need to be able pave the way for them to utilize it in the best way possible. These are our leaders of tomorrow and it would be a deficit for them to have a teacher who didn't know how to open some doors.

Tonya and Norma wanted their students to have opportunities to use technology. Both realized the increasing amount of information available was advantageous for them as teachers and for expanding the knowledge base of their students. Cathy's comment

about keeping pace with others for social events triggered her personal need to become more comfortable with technology.

While the ubiquitous state of technology suggests that more emphasis or demand for improving technology skills might have been appropriate for policy decisions, these teachers sought to expand their knowledge independently through self motivation and self determination. All six faced a number of challenges along the path to change. Technology related professional development through the district was scantily supported. Though the district approved the training of approximately fifteen Intel Master Teachers, no consistent support or encouragement from the district followed to expand the Intel mission of teachers training teachers. Master Teachers returned to their individual buildings obliged to create their own programs for further Intel training. Support at the local school level was inconsistent with principals being tolerant rather than encouraging. The program never became a part of the designated professional development days or included in menus for session selections.

There is no way to avoid mentioning the lack of adequate equipment in classrooms particularly in this district. One computer per thirty five students is an abysmal ratio to expect much to be accomplished by teachers or students. Districts tend to counteract this data by including computer lab and media center equipment in order to reduce the student to equipment ratio. During the 2005-06 school year the district added two new computer labs in the middle schools. Add the new labs to one existing lab and the media center and the number of pieces of equipment in each school increased by approximately 140 computers. This increase in equipment reduces the ratio but not

enough to make a difference especially for the classroom teachers who do not have regular, equal access to it.

Add the time it took to replace equipment and over time the ratio is further reduced by what is no longer functioning and beyond repair. One could question the practicality of investing the time to use something that may be, in a short time, out of date or in poor working condition. While much can be done with one computer in the classroom, four to five units in the classroom can be effective for changing a teacher's practice (Burns, 2002), learning about integrating technology, and for building students 21st century skills.

Tonya's situation as an elementary teacher with a computer and a program to support student reading and later as a middle school teacher with no computer for eight years provides a picture to explain why teachers collectively have not moved forward with educational technology. The inconsistencies with the availability of equipment make for inconsistencies in what we can expect from classroom teachers. Personal productivity or uses outside of the classroom would tend to be a more determining factor as reported by Schrum (1999) when we look at who has the knowledge about technology that could be integrated in their content.

Equipment became another challenge for this group of teachers. Far too much of the technology available to them was outdated or malfunctioning. During the days when things were fresh and new, they knew little about what to do with the equipment. Recalling Norma's explanation, "There was not a big emphasis during the time that I was taking those workshops on integrating technology in the classroom (56)." By the time they became more proficient, the equipment was beginning to fade and its usefulness

wane. During my interviews with Cathy and Tonya, both were experiencing difficulties with their equipment. Getting access to computer labs or portable equipment was also daunting. Norma knows this all too well,

> I can only go a certain time to use the equipment because there is a group of everybody who is trying to use the same equipment. ... you have only a certain length of time when you go to the computer lab ..." (68)

The restrictions on when she could take her class and how long they could stay made using the computer lab more complicated than not using it at all.

The more tech savvy teachers booked equipment time early and more frequently making access difficult for teachers less certain of how or why to use the technology. Lack of knowledge meant not understanding why something might be in demand, therefore, obfuscating last minute or short time frames when requesting access. Instructional computer labs, most not in use for as least one period each day, were under utilized. Teachers are reluctant to encroach on another teacher's instructional space. There is a sense of possessiveness and the desire not to disturb others working in their classroom during planning time.

Teachers were also fearful of students using equipment, especially the lone computer in each room. Despite a directive relegating the lone computer in the classroom for use by students, teachers were still overly cautious of students using equipment and teachers continued to restrict access. Zina, unlike most of the other teachers had an additional computer, yet was not willing to include access for one of them. She stated, "I am limited because I have one computer available to them and one computer in my office which I am reluctant to make available to them." Norma described her control of access this way –

> If I have asked you to use the computers, they will come to my desk and get on the Internet and research whatever they need. I print it off and they go back to their desks because I have more students and only have one computer in the classroom. (98).

Because this was the only computer and daily attendance was required, teachers wanted to be certain it was in working order at all times. In effect, it became the most under utilized and most costly equipment in the classroom. Daily attendance consumed approximately thirty (30) minutes out of the school day. Ironically, since student access was limited or restricted, students had little opportunity to share their technical skills with the teacher or with other students to the benefit of all.

When the district technology support staff changed the operating system on Tonya's computer, what was working ceased to do so leaving her with no working equipment for her or her students. Getting new equipment in her building meant signing up for consideration when a batch of new computers arrived. Norma spoke about getting added to the list but lamented that teachers had to justify their request. She found this disconcerting because her lack of knowledge meant she would not know how to apply and because she had antiquated equipment she could not learn how to do more.

> …they said that they were going … to be giving out new computers next year. But what you have to do is write up a plan on how you're going to use the technology. And I felt like no give me the computer and then you come in and have someone to teach us the new programs or how technology can be integrated into math. How it can be integrated into science. (66)

Fiona's protective attitude toward the computer changed after her Intel experience. She relocated the classroom computer and stated,

> Before I was … I would say we would still look information up on the computer but I wouldn't let students go by themselves. I just didn't trust that. But the way my computer is set up in my classroom I can see what they're doing and I feel comfortable enough if they get in a bind, they can't figure out the information, I can go over and say let me show you. I wouldn't have done that before. (84)

## Reflections on Professional Development

Professional development either general or technology related was an issue for these teachers. Collectively they had mixed responses on the quality or content of the professional development provided by the district. All found the district policies on the content or topics offered lacking. Norma, for example, wanted to know more about teaching students to write, however, the writing professional development available crammed the content into too short a time frame to leave her feeling confident. Teachers indicated that some technology classes were offered such as GroupWise, an email system or sessions on the electronic system for recording quarterly grades. What they did not mention were sessions specifically for instructional technology. Professional development on how to use technology in the classroom was not reported as an option for any of the teachers in the study. While the Intel program fit this category, it was not a program supported or endorsed by the district. In other words, it was never offered as an option or selection for required professional development days.

We know that professional development to meet the individual needs of teachers is problematic. Such an inservice commitment is generally cost prohibitive (Koppich, Toch and Podgursky, 2000). Offering generic topics such as classroom management or Cathy's "Creative Movement" allowed the district to reach more teachers with fewer consultants. Koppich, et al. also noted that federally funded professional development is typically relegated to core academics "to support teachers' subject matter knowledge and mastery of subject-based pedagogy (p. 265)." Little is mentioned in their writing about the role of the federal government in professional development related to technology except the following statement:

In addition, Eisenhower funds could be used to align states' teacher licensing requirements with new standards; recruit underrepresented groups, such as minorities and women, into mathematics and science teaching; and train teachers in the effective use of educational technology.( p. 274)

The most telling word in the above quote is the word 'could.' We could interpret from this one word that educational technology was not a necessity for teachers or a requirement. It appears to be an after thought for the distribution of funding, leaving state education departments with the notion that educational technology is expendable or unnecessary for the nation's teachers. Providing professional growth to build human capital, that is skills that meet the needs of the organization based on specific criteria, is expensive. Unlike some private sector industries, teachers come prepared to do the work by virtue of their credentials. Therefore, a conscious effort must be made to create teachers who in addition to be being strong in their content or subject matter would also be strong in the use of educational technology.

***Reflections on Teacher Use***

By 2004, technology in education was gaining momentum. However, the six teachers in these cases, most in Cohen's (2005) second half of life, had limited experience using technology either personally or professionally. Generally personal productivity is the first phase for setting the stage to introduce technology into the classroom. Discovering the potential of a piece of software or equipment through personal exploration and use helps to build confidence and skill. The group of six had few personal experiences. Fiona, Norma, and Olivia used word processing for lesson preparation but did not necessarily include this function with their students in any capacity. Internet access was the one common factor for all six. Most used the internet for personal retrieval of information which they then used in their classrooms. None had

reached a stage where many teachers, albeit mistakenly, view internet research as evidence of technology integration. Cathy, prior to the Intel program, had never taken her class to the media center to do research online. Norma needed the Intel experience to start her use of PowerPoint. Although MicroSoft Office products were installed on all district computers, she had never explored the software.

> If I hadn't had the Intel program I would not be doing the PowerPoint. That was one of the things that we did learn in the Intel workshop. Because I wouldn't know what to do or how to bring the program up. I would see it on my computer but I never would push the button to turn it on. (52)

All of the teachers found some way to include technology after their Intel experience. Olivia, for example, appreciated being able to mimic her peers with their impressive handouts. She and Zina were more willing to be adventuresome by bringing portable writers to supplement student work in their content areas. The use of PowerPoint increased for most of the teachers. The data implies that teachers felt this technology was easy to use with students and that their students would be willing to use it.

Tonya's comfort level with the use of PowerPoint, supported by a resource in her building, encouraged her to use the product with all of her classes. With Intel behind her and support in her building, her previous method of initially introducing new learning strategies to one or two classes allowed her to move forward with all six of classes at the same time.

### Reflections on Sustainability

The effectiveness of any professional development is always a concern for providers and participants. One of the objectives of this study was to identify evidence to demonstrate the effectiveness of the Intel program. This was not the primary purpose of

the study and as facilitator there was a concern that the participants would be tempted to provide positive feedback to avoid embarrassing their former workshop leader.

Research literature on professional development identifies several characteristics of effective professional development. Of those not controlled by district and administration policies, four were represented in the data analyzed for this study. Teachers in the study made positive references to the following characteristics: duration of the inservice (Cohen and Hill, 2000), content directed toward student achievement (Desimone, Porter, et.al., 2002), active learning as participants (Borko, 2004; Hargreaves, 1999; Hawley and Valli, 1999), collaboration and collegiality (Hargreaves, 1999; Sugar and Wilson, 2005; Zhao and Franks, 2003), and on-going support of their learning (Hawley and Valli, 1999). Compared to the district sponsored professional development teachers identify more characteristics of effective professional development when discussing the Intel program.

Fiona and Cathy spoke of the collaboration and collegiality of the program which allowed for the sharing of knowledge between participants. As active learners teachers gained insight into how their students might react to lessons infused with technology. Because the program duration was longer than typical after school or half day short term workshops, teachers felt they had greater opportunity to apply what was learned and report on their successes and failures at subsequent sessions.

Though the Intel program was designed for a finite conclusion, teachers indicated the need for on going support. After several weeks of having instructors available, teachers wanted a person who would continue to work with them in their classrooms. Even eighteen months after the initial Intel course, three of the teachers in the study

participated in a repeat of the course. The Intel program offered online support but this group of experienced teachers did not demonstrate a comfort level that would allow them to use this resource when the face to face contact ended.

A major consideration in selecting experienced teachers for this study was the opportunity to inquire about what could be done to support them in using technology in the classroom. If they had neglected or ignored technology and were now prepared to rethink it as a viable instructional tool, what would they like to have to help them in their endeavors? None of the teachers in this study indicated in any way that technology in their classroom would not in some way benefit their students. They realized that most of their students were already users of some form of technology and extending its use to the classroom was simply a logical next step. They, the teachers, were the problem. They, by their own admissions, were not knowledgeable enough to know what to do or how to do it. If they were willing to learn and if they realized the possibilities after the Intel program, what more was needed to make them successful, confident, and closer to fluency?

Teachers in this study also reported that resources for clarity on using technology in the classroom were scarce. Some initially cited the district support desk as a source for help apparently unable to distinguish between hardware trouble-shooting and support for using technology for instructional purposes. Often an additional probing question was required to separate the notion of malfunctioning equipment from details about the lack of understanding about how to use technology to enhance or support certain content.

Two things became clear: 1) teachers did not know where to find resources either within their buildings or outside; and 2) teachers wanted a person available to them to

"model" use and support their efforts to try to understand the instructional uses of technology. Olivia's conclusion that "winging it" (172) would help her move forward was most revealing about how teachers saw support for technology. That teachers must learn instructional technology strategies in isolation means reaching a point of fluency and competency will take more time and delay meeting their own and their students' need for fluency.

Tonya was the only teacher in the study who came close to meeting this need for a resource person. She used the media center staff to teach her students and initially became a student herself in order to learn a particular application. By being able to return to the media center in a timely manner, this resource was available so that Tonya "would just take the lead and just holler for her when I got a little stuck (20)." Individual attention was an important factor for Tonya in learning to be more proficient. Her sessions at the public library met in small classes "so you get lots of hands on and individual attention (58)." As a result it made her feel "more confident with the computers (60)."

All of the teachers in this study wanted individualized and personalized instruction designed to help them obtain specific strategies even if they could not articulate them. One example was Norma's frustration with a plan for using technology in order to acquire new equipment. She wanted the equipment first and then someone to tell her how it could best be used with her students and her content. Not knowing placed her at a disadvantage even if intuitively she knew more was possible. Cathy was persistent in her request for a person to come to her classroom and patiently demonstrate to her and her students. By observing a knowledgeable person she would then be able to

replicate the lesson gaining confidence and skill. She was simply not prepared to go it alone once the support structure of the Intel program concluded.

Tonya also found two computer teachers in the building to be good resources. Her experience with her colleagues proved very beneficial. However, her ability to find supportive peers did not carry over to Norma who worked in the same building. Note the different perceptions in the following statements:

> Tonya: We do have a media person ... one of our media persons who is very willing to show you how to do different things on the computer [and] also to demonstrate for your class. So ... that's available. We have two other computer teachers in the building who are very kind about helping if people need assistance. (139)

> Sandra: Suppose you thought that mail merge would be a good thing to use. Who would you go to to ask that, to ask for help?
> Norma: Right now to be honest, nobody. To me there is no one available. There's no one available because I've spoken to some of the tech people in the building and even with PowerPoint they said they didn't know how. That they didn't know a lot about it. (111 – 112)

Another contradiction can be found when the discussion of new equipment arose. Tonya felt confident she would receive one of the new computers when they arrived. She stated, "But we have some new computers in the building and I was told that I was on the list to get one of the newer ones (149)." When asked why she thought that would be possible she added, "I guess the gentleman when he came and saw my antique [and] he felt sorry for me. We need to help you (151)." Norma, however, was told to write up a plan in order to be considered for new equipment. "But what you have to do is write up a plan on how you're going to use the technology (66)."

Olivia at Yardley and Tonya at Central were the fortunate ones since they were able to use their social networks to solicit assistance. Each had people they felt comfortable approaching to seek help and who were willing to show them unfamiliar

techniques. However, it is interesting to note that the other teachers did not find these same resources available to them in the same buildings. For example, Zina mentioned not wanting to impose on other teachers in her building. Norma indicated that no one in her building could answer her questions about PowerPoint. Implied here is an imbalance in the interaction among teachers within the same building. How is it, we might ask, that one teacher is able to get the support she needs, but not another? A consideration for further study may be how social networks in schools can be used to more effectively distribute knowledge about the integration of technology.

Understanding the social network of the school (Penuel and Riel, 2007) may provide a method for determining if and where gate keeping of information about technology exists. These conflicting views of how knowledge was transferred within the building implied that information reached some teachers and not others for some undetermined reasons. We could begin to question the social capital of one teacher over that of another and how each relationship influences the flow of information for school reform in general.

### Final Thoughts

If we are to view teachers in this study as representative of others in similar stages of their teacher life cycle, it is clear that changes are necessary in the role of professional development in increasing fluency in technology. One viable solution may be the availability of a "knowledge broker" (Oldham and McLean, 1997) who functions as an intermediary between those with a specific knowledge base and those in need of such knowledge. Plair (2008) recounted how knowledge brokering can be a way to 'revamp' technology related professional development. Five roles were identified for the

educational technology knowledge broker: harbinger of information, master of strategies and techniques, teaching artist, Johnny-on-the-Spot, and catalyst for change and unity. These roles allowed the knowledge broker to manipulate technology related knowledge to best suit the needs of individual teachers, content areas, schools, and possibly districts. Knowledge brokers would be prepared to create, acquire, assimilate, utilize, and disseminate knowledge related to educational technology as needed by teachers.

These knowledge brokers are already present in some schools and districts under such titles as instructional technologist, technology integration specialist, and educational technology specialist. Their function is very similar to the often federally funded positions such as reading, math, or writing specialists or coaches. Districts would do well to include the technology integration specialist or knowledge broker to the ongoing professional development of its teachers in a transition from Shulman's (1983) PCK or pedagogical content knowledge to today's version of TPACK, or technological pedagogical and content knowledge (Koehler and Mishra, 2005). Just as teachers once needed to maintain strong competencies in content and pedagogy, knowledge of how to support these areas with the use of technology is just as significant.

Administrators and policy makers would do well to recognize the influence a technology rich curriculum can have on student achievement. When a teacher, like Olivia, reports on her students' engagement and eagerness to participate in their learning when using technology, we can, at best, surmise that some learning is occurring and increased achievement is a likely outcome. Because technology innovations change so rapidly, research literature on technology and student achievement is sparse. Therefore, teachers skilled in educational technology strategies should be encouraged to continue

integrating technology and document their successes, and failures, through action research. These smaller studies may help disseminate information more quickly about the relationship and effectiveness of instructional technology and student achievement.

Over time the number of teachers with minimal proficiency or fluency in technology will diminish. New teachers, some of them digital natives, will eventually fill classrooms of aging teachers. We should, however, not assume that new teachers are automatically able to convert their recreational technology use into effective instructional technology strategies (Plair, 2007). All teachers need the ongoing benefits associated with a knowledge broker to keep abreast of changing technology, to discover new instructional strategies, and to sustain and enhance their existing levels of technology fluency.

The new TPACK focus will help change attitudes toward the use of various technologies in the classroom. This 'movement' is focusing on the use of technology in practical and 'appropriate' ways in concert with each content area. (See http://www.tpack.org/) While supporting efforts to provide students with 21st century skills, teachers are encouraged to look for ways technology adds depth and richness to the content they teach and the pedagogy that defines their practice. But even with the increasing recognition that technological knowledge is necessary, changes are needed in how to effectively and efficiently help teachers to make sense of how to use technology in their content and in their teaching. Expecting them to continue in isolation will not create a climate of change. Providing extension technology related professional development, like Intel, and placing a knowledge broker within easy reach may be key to meeting the needs of even the more reluctant and 'fearful' experienced teacher.

# Chapter 4

## A Tale of Three Teachers: "Running as Fast as I Can"

In this chapter we revisit two teachers from Chapter Three. Five years have passed since the initial Intel professional development event. Since that time, two of the six teachers have completed another iteration of the Intel course and participated in a 20 hour professional development activity that I developed and facilitated to explore how to teach in an online learning environment. I also requested research approval so that I might capture the discourse of teachers in the midst of a technology related professional development and several hours of this inservice were recorded and transcribed. A new teacher enters the picture in this chapter because she functioned initially as a facilitator for the Intel inservice and then later as a participant in the online learning professional development activity. She is able to facilitate technology related professional development because of her technology skills but provides the viewpoint of a participant because she knew little about how to integrate technology into her classroom until late in her career. The chapter explores how the teachers have been coping with this notion of technology fluency and integration in the ensuing years.

These three teachers have been colleagues over the span of my teaching career in a district previously defined as urban based on the large numbers of At Risk students. They are teachers I respect for the work they do with children and for the way, over many years, they have tolerated and indulged me in my personal educational technology crusade. Over the years we have shared some of the same students and those students have shared the technology of the computer room with them, their often baffled content teachers.

## Preparing the Canvas

In this chapter, I return to portraiture as a way to present the three case studies. As in the previous chapter, this method allows the researcher and the subject to enter into a more relaxed relationship (Lawrence-Lightfoot, 1997). Because these women know me as a colleague and as a facilitator, the ease at which we were able to interact allows for a more open dialogue. Although, it is also important to consider that because of this relationship, what they tell me may be shaped in ways that are more positive and may be tainted by an avoidance of any negativity that might 'harm' my work.

Each case study was developed in the same manner. An interview protocol was developed and the semi-structured interview sessions were arranged in such a way to eliminate any time restrictions. In other words, each interview session ended when time became a constraint and a subsequent time to continue was arranged. We continued meeting until all the questions were answered. During the interviews, additional probing questions were used based on the skill level of each teacher and if the interview took an 'unexpected' turn. On occasion, emails were exchanged in order to clarify an answer or probe for more information.

Data was collected via audio recording and each interview was carefully transcribed by the researcher for later data analysis. Because this study asks subjects to recount historical practices and events, the transcripts were coded in an effort to derive the best accounting of each teacher's personal experience with technology. Three general themes were foremost in the analysis to provide a sense of consistency within the framework of a historical, yet individual perspective. The three themes are:

- How do teachers reflect and react to the educational technologies encountered during the course of their teaching careers?

- How do we describe the attitude of these teachers toward instructional technology in contrast to the initial interviews from Chapter Three?
- What can we learn about how teachers cope with the complexities of trying to include educational technology in their practice?

## *Background*

Over a period of approximately five years I had advocated for various technology related professional development activities within our district. My personal goal was to help my colleagues do what I did – teach with technology. While Cuban (2002) chastised educators for not utilizing expensive computers in the classroom, I, after spending several years working with technology for a large corporation, could only see a greater need to prepare students for a workplace filled with computers and more. I also saw technology as a great tool for learning and as another option for presenting content, testing ideas, locating information, and collaborating with any number of distant characters related to education.

My colleagues, however, did not see technology as a tool for teaching or for learning except for the occasional drill and practice typical of early adaptations of technology in classrooms. Teachers seemed to take the position "that computer classes and their applications were not the purview of the content area teacher or classroom. Word processing and spreadsheet programs were something taught down the hall under the domain of some other teacher (Plair, 2008, p. 71)." By choosing to focus on these three veteran teachers, other teachers, administrators, and policy makers will hear their stories and understand the difficulties involved in the metamorphosis of becoming more technologically fluent. Adding technology to your teaching is relatively simple if you already have a pretty fair idea of how the stuff works. These teachers demonstrate that

even with the luxury of prior knowledge making the trek to technology fluency is quite a challenge.

*A Tale of Three Teachers*

*Meet the Teachers*

All the teachers in the cases that follow are experienced or veteran teachers. At this stage in their teaching careers they are well established; skilled at classroom management; knowledgeable about their content; and wise in the political climate of their district. They are often mentors of preservice and new teachers and have extra curricular duties beyond the school work day. That technology had not found its way into their classrooms was strange to me and over time I appreciated their patience and support for me as I tried to provide opportunities for them to change their practice with the infusion of technology.

Cathy was probably the impetus for beginning this whole project of looking at experienced teachers and technology. She was the most 'needy' when it came to technology and the most receptive to my attempts to prod her along. She was the clean slate I thought would become a shining star once she had lots of exposure to educational technology. As a traditional teacher, Cathy's classroom was pretty predictable. Projects and course requirements did not change much from year to year. Hers was usually the first name on any list when a technology related inservice became available because I made sure she heard about it first. When you hear her story you may wonder if she participated to appease me or out of genuine curiosity. There are moments when the distinction blurs.

Peggy is a complete contrast to Cathy when it comes to technology. She has always been the tech savvy one who loves to have the latest technology gadget for her personal use. While her comfort with technology creates the difference, she did not integrate technology into her content area either. Even though her classroom is filled with gently used and often discarded computers, how her students used technology was stuck in the early period of drill and practice or reward for good behavior. Her name was always added to any list of technology related professional development because of her personal knowledge of technology. It was through these experiences that she began to understand what it meant to integrate technology.

Zina was selected because of the work she does not only with her students but with other teachers. Her teaching responsibilities are directed toward a select group of students that she refers to as 'our future leaders.' Her goal to help them meet the challenges of the 21st century was and is commendable and I have the highest respect for her as a fellow educator. That her students were not using technology during their time in school was alarming to both of us. It became her personal goal to change this circumstance and for my part, I alerted her to any technology related professional development activity on the horizon. Today she has more computers in her classroom than most teachers in her building and she purposefully seeks out ways to enrich students' lessons and her instruction with technology.

### It's All About Trust

Cathy and I had been colleagues for a number of years. Our classrooms were on the same corridor and our daily contact consisted of a few moments of conversation en route to other destinations. Our schedules and our content areas were very different so

developing a more in depth personal relationship never occurred. As with other teachers in this study, we were professional colleagues who respected each other as educators and women.

As the de facto technology expert in the building, I frequently sought out teachers who exhibited little or no use of technology in their classrooms and recommended them for the few technology related professional development programs available in the district.[1] Since Cathy often stopped by my classroom to marvel at the activities of my students, when I learned of technology inservice opportunities her name was frequently at the top of the list of potential participants. It was my way of encouraging her to join the 21st century and offer her students new and different ways of learning.

Cathy and I were also active in a three year professional development program designed to encourage the teaching of interdisciplinary project based learning. This contact strengthen our professional knowledge of one another and created a social network link with the other participants. We often came together to discuss progress and cross curricular options over this period. Some of the participants in this professional development would later participate in technology programs either under my direction or with my encouragement and have been research subjects for other studies during my doctoral program.

In Chapter Three, Cathy was one of the six teachers interviewed after the initial Intel program professional development. If we were to assign a phase or level of

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[1] On returning from state conference I emailed the superintendent stating my dismay that our district was not represented by two programs designed to assist teachers with learning technology. Those programs were the Ameritech Technology Academy Scholars I/II program and Intel Teach to the Future. Within two years funds were provided for two sets of ATA scholars (teams from a limited number of schools) and the training of approximately 15 Intel Teach to the Future Master Teachers. Master Teachers were then left to own devices to 'train' other teachers without funding or support from the district.

technology fluency at that time, Cathy would be considered a novice user. Prior to the Intel program she was essentially a non-user of technology; using it only when there was no other option. Using technology created fear and anxiety but she had decided to make an effort to learn more things and allow her students to include technology even if she did not know how to do things herself. Like many teachers, she felt if she was not the skilled technology person in her classroom and did not know everything about the software or technology tool, it could not be used in her classroom. Teachers were the knowledge brokers (White, 1987) for all things and she was unwilling to admit to her students that she did not understand the technology or know how to use it. To my chagrin, when we met again in 2009 for this study about experienced teachers and their travails into the realm of technology fluency, I found that she had actually 'regressed' and essentially given up any hope of becoming fluent enough in technology beyond some of the required productivity tools implemented by the district.

Over the years Cathy became an ATA Scholar I (Ameritech Technology Academy). She spent over 80 hours in two Intel Teach to the Future: Essential Course offerings and participated in a 20 hour grant funded professional development event to help teachers understand the new online learning requirements in our state. This later event also had research approval to record the inservice 'live.' Many of these programs allowed participants to walk away with a variety of "techie toys." Cathy has received a web cam, flash drives, a digital camera, digital recorders, a graphics tablet, and various software applications. As the professional development organizer or facilitator my goal was to provide teachers with tools that belonged to them and not their schools or districts. I reasoned that providing teachers with their own personal technology tools meant they

were more likely to experiment with using these tools for either personal or professional use if they actually owned them. Schools often restricted the distribution of equipment. Items were often not allowed outside of the building and there was always the issue of loss or damage to 'public' property. My goal was to remove at least this one obstacle and thereby remove the excuses or another barrier associated with learning to use technology.

At the time data was being gathered in 2006, Cathy had completed one round of Intel Teach to the Future training and was participating in the second session with primarily a new set of teachers. Over an 18 month period between the two sessions she had been exploring the use of technology in her classroom. Her greatest concern at the time of that study was the lack of a person, a knowledge broker, to help her over the hurdles. She emphasized repeatedly the need for a person who would dedicate a specific timeframe to assist her in her classroom with her students in some area of technology. This has not happened when we meet again. She has been left to her own devices and must be her own technology advocate. It doesn't work.

For example, Cathy still does not have the skills to find things on the Internet. Although through various professional development events she has been introduced to some of them, understanding how to effectively use a search engine just does not seem to have clicked. It becomes clear in the following dialogue,

> Cathy: I would also like to see some sort of a, doesn't have to be online, but somebody just once in a while send you, you know, hey, did you know this is out there? Or these things are out there and available to you ... some resources that will point me in the right direction.
> Sandra: There are plenty of resources on line so the question is why don't you know about them? .
> Cathy: But no, then how do I go about ... what would I type in? See if I still don't have the knowledge ... (548, 551, 552)

When uncertain where to go next, Cathy has the tendency to trail off leaving unfinished sentences. Her obvious limitations led me to wonder if we are making assumptions about adult learning and use of the Internet. None of the professional development events that I had organized or facilitated had included detailed instruction on how to navigate the Internet or effectively use search engines. Aside from not being a part of the workshop content, there seemed to be an underlying assumption that adults would make an automatic transition from search skills used in a library to searching for information on the Internet. In the case of Cathy, this is probably a faulty assumption.

In fact, I leave the first interview session with Cathy stunned. She was to be my poster child for the experienced teachers who had found the merits of technology and been converted to a whole new being at least in her classroom. To my dismay, I find that she has essentially abandoned all efforts to become the teacher with her technology rich curriculum and the envy of her colleagues. Though she attends the occasional workshop that might include technology, she has ceased making any effort to do things or explore on her own.

I recall leaving the first interview almost weepy. What was to become of my research? My whole premise that experienced teachers could become great technology teachers if we only understood the underlying complexity or process for this growth was shattered. Cathy had lost interest and any further discussion seemed pointless. I wanted to use her journey from novice to expert as an example of a change in practice only to find that in the three years since our last inservice she has receded like a turtle into its shell.

Between interviews I managed to rethink what to make of this alarming turn of events and realized that Cathy's story may not be all that unique or unusual. If there were other teachers who had tried to stoke up some degree of fluency in technology and either failed or simply gave up, it was important to know why and allow their stories to be heard. Cathy would serve as the representative for those teachers who would decide that, 'yes, technology is nice and even important, but I will not be the one using it in my classroom.' Cathy was now much like Janine from Chapter Two with the exception that Cathy had once been open to the initial efforts to change her practice. Now I just needed to determine what had caused her to give up and retreat.

By the next interview Cathy has softened her position of complete lack of interest. I worry after replaying the recording whether she has deduced my distress and is attempting to placate me in some way. It would be very much in her character not to disappoint me or inadvertently sabotage my work. I hear glimmers of real interest but without enough substance to convince me that any changes would occur in her teaching practice. It is as though my grand experiment has failed. No matter how much technology I have placed before her, the lack of constant reassurance and ongoing support proved too detrimental for her continued progress.

With Cathy it is really a matter of trust. Obscured by references to fear she does not trust herself to know what to do and she doesn't trust the technology, especially the computer, to keep the information she needs safe and secure for a later time. She speaks often about pressing a button only to see all her work vanish or arriving one day to find that her classroom computer has malfunctioned holding her information captive. She admits to using dual recording procedures for her grades. The classic grade book is ever

present and, for her, dependable at all times. What she may not realize is that even the most technology literate users keep backup copies in various forms in the event that the catastrophic actually occurs. She does not see this duality as normal and prudent but as conformation that her bad karma with technology requires her to cling to the old, tried and true way of doing things.

Because of her fear or what she calls, 'bad karma.' "... and maybe it's just my bad luck or karma, but usually even when we would have classes with you, if something could go wrong with the machine, I'm usually the one sitting at it (328)," she is reluctant to release many of the non-technical methods that foster a sense of security. For further affirmation she relates the one time she was brave enough to shop online and her account became part of an attempted fraud.

> Couldn't have been three hours later my bank calls and says to me – I need to verify something on your card out of something Texas to the tune of two thousand and some odd dollars. See what bad luck - karma? I told [my husband], this is what happens to me. (374, 378, 380)

She has not taken advantage of much of the technology introduced and sometimes actually given to her during previous technology related professional development. Faced with a new piece of technology she unabashedly admits the likelihood of using it is not high. "If somebody gave me a piece of technology and something to use even in my classroom, you know, unless someone showed me how to do it, no, I probably wouldn't use it. Not at this point in my life, I really and truly would not. I am going to be honest with you." (104)

Over the three interview sessions, Cathy vacillates between total lack of interest and casual indications of curiosity. The need to be fluent in technology has become a narrow focus of being something fun and personal with little connection or concern for

finding a place in her teaching practice. Disenchanted, Cathy places some of the blame on her age and her decision to retire within the next year. "And I'm probably like a lot of other folks – I hope I retire before they make us do whatever else is coming down the pike (620)." There is a sense that time has run out for making any significant changes.

We retrace the educational innovations over the span of her career and determine that her use of various early technologies, such as opaque projectors, was not especially unusual. She recalls the evolution of copy machines and video formats such as 16 millimeter film and the manual film strip. The inclusion of VCRs and the transition to the current DVD format did not seem to put her off. "I've gone with the flow with everything and I know how to work those kinds of things (108)." But my initial question about educational technology has drawn a blank. Cathy's view of technology is limited almost exclusively to computers. She tries to sort out her thinking about technology in the following:

> When you consider a tape recorder technology see I'm not, you know, when they say technology the only thing comes to my mind in that darned computer. And I don't know … and I don't know why it pops in there. And that's the only thing my vision is seeing. If it means technology it means I need to be doing something with that computer in my classroom. (108)

> … now that you mentioned it I'm going to broaden my scope of it. (110)

> I mean, it's all technology but the light bulb didn't come on until you said so. So I guess you know there are endless possibilities out there but unless somebody either turns on the light, opens the window, you don't know what's out there. You're still at a loss. (542)

When I ask Cathy if she feels her students are getting what they need to learn 21st century skills, she indicates that other teachers are doing what she can not do. "But no, I don't have that fear for my students because I know they're getting it somewhere (134)." She knows other teachers, especially ones not in her age group, include some technology

in their teaching although she does not know the extent of this use. Since there is no forum to share ideas about technology use in the classroom, it is not clear how she came to this conclusion. Nevertheless, she states with a tinge of regret in her voice, "It can't be me because I don't have the background and the knowledge to take them forward (194)."

Cathy shares that her personal goals for the year are to master some of the district's electronic administrative tools. In order to achieve this goal she has been using her social network to find other teachers who are willing to act as resources and they have been patient with her lack of finesse with the computer. She provides an example with the experience she had trying to navigate through an electronic grade book program and how two teachers patiently helped her get through the process.

> But like I say, if it weren't for people like that and who can kind of laugh with me and as I would say to them, you all are just going to drag this dinosaur out of her cave yet before it's over. (74)

A bit surprised by this comment I turn our discussion to the fact that it has been five years since the first Intel Teach to the Future inservice. To which Cathy simply replies "I have less now than I had then (76)." To clarify she continues, "Because I don't have a class or someone like you ... (78)."

There is an undercurrent of frustration and bitterness toward the district decision makers related to some of the required technology use. Email had become de rigueur and Cathy finds it an imposition rather than a move forward. "I have now more of – 'this is what you need to do. I'm not sending any more hard copies (78)." Discontented with the change she notes that "downtown sends everything on email so therefore I'm (*referring to the school administrators*) going to email and there are no longer, you know, our little

staff updates on hard copy. You have to go online to get it (576)." She provides another

example of administrative inconsistency which focused on an online tool.

> [*Product*] seems to be important to them, but where's the training and that's been
> out in our district for how many years? Okay? So just don't give me a little dip
> here and a dip there and that's it. You know, it has to be ongoing for me. It has
> to be something that I'm going to use and going to do. (546)

Change it seems would be more palatable if she knew that she and her colleagues would

have adequate preparation for implementing the change.

Cathy further rationalizes her lack of interest by contrasting her situation with a

friend in the same age group who received more support during a transition to new

technology. If you ask, Cathy can provide the solution to this conundrum. She needs the

same opportunities for learning about the integration of technology that her friend

received.

> ... we do have one middle school in our district where they kind of focus on this
> technology, all the kids had, [*laptops*], and a friend of mine, she's retired now she
> was really dragging her heels gungho, 'I don't want to do this here.' But once
> they got her involved in it she loves it. Okay. But you've got everything at your
> hands. You've got everything there that you need. Don't offer me something or
> some sort of new fangled device and only give me bits and pieces of it, okay. Or
> either, well, 'we're going to order this part of the program but we can't afford that
> part of it.' And it's usually the technology part of it that they can't afford. (132)

> I don't know what kind of money OMS got when they all went with these laptops
> and all this here kind of stuff and [*friend*] drug her heals from not doing anything
> to technology to now these laptops are the best thing since sliced bread. So what
> drug her from one point like me to where she is right now and it was the
> availability and the fact that they were interested in training [*emphasis on
> training*] them to do this. (546)

Since all schools in the district were not treated equally, all teachers were not treated

equally and for Cathy this inequity makes all the difference between growing in fluency

and becoming stagnate.

*Bring It On - I'm Fearless*

Peggy is included in this chapter because of her comfort with technology. She provides a contrast and a middle ground between Zina and Cathy who both started with limited technology skills. Peggy, though comfortable with technology, did not teach with technology and recounting her growth and change in this area is worth telling. Her journey with integrating technology demonstrates how teachers can change their practice with effective professional development.

As colleagues Peggy and I connected because of our interest in technology. Since I was active in the district's technology committee, I often knew of resources which would be of interest to her. When technology related professional development became available, I included her name hoping that the content would help her to use the technology in her classroom more effectively. Later, as Intel Master Teachers we would share the workshop leadership duties though Peggy initially avoided being on center stage as a presenter. She chose to be a support person providing individual attention for the participants who floundered. Today she feels confident that she could do it all and explains it as follows:

> Peggy: ... having done it a few times is one thing but I've presented at some workshops by myself and I think that in itself just helped me realize how much ... I think the more you do stuff like that the easier it gets and because I've done that and things have gone well and I think it's made me realize, hey, I can do this stuff.
> Sandra: Do you think that it was the difference between dealing with adult learners rather than the students that you normally deal with that made a difference for you?
> Peggy: Well, definitely, well, your peers, you know, you just think they're adults and they probably know as much as I do and are they going to listen to me type of thing. And then you realize, hey, they really do listen and are grateful and everything. (429 – 431)

Peggy is a techie at heart. Her personal life is filled with the latest technology gadget and she explains that she eagerly uses all of them. "… I like to know the newest gadget. I like to learn about them (90)." That she did not teach with technology seems a bit strange initially. Like most things in our lives, someone just needs to show us how it's done. Peggy's revelation about teaching with technology came from her participation in the Master Teacher training for the Intel Teach to the Future program.

> I think I've always wanted technology in the classroom but to include it in the lesson probably started more when I started that Intel class. It made me think of it in a different way. You know, of it being part of the lesson not just a toy or not just something separate that's outside. You know what I'm saying? It's not just another thing; it's part of what you're doing. (114)

Our backgrounds are very similar in that we both began our trek into technology by taking programming classes in the early 1980's. Peggy uses the birth of her first child as a milestone to mark her beginnings as a 'techie.' Her daughter, who was 28 years old at the time of our interview, has never known a time when there was no computer in her home. The logical next step for Peggy was to begin her teaching career tracking "down a computer so I could have one in my classroom (464)."

Like me, Peggy is mostly self taught when it comes to learning how to use many technologies. Over the years she has attended a variety of introductory workshops and then used this basic information to work alone at home enhancing her skills for some new application or gadget.

Peggy perhaps has the clearest understanding of what it means to integrate technology. This becomes more obvious during our discussion of innovations in educational technology. She embraces change easily and is not intimidated by the

newness. It is the newness she finds intriguing and the fact that she can approach the

content she teaches in a new way.

> But, you know, some of the things get replaced. It isn't that it was a fad necessarily but like the overhead projector is now being replaced by the computer and the presenter. So the VHS tape and the reel film was replaced by DVD, you know, so something better came along so it's not that we threw that away necessarily, although we did, it's just it's been upgraded and you keep up with the times. (204)

> I think that I would probably keep the lesson and keep what I'm trying to teach my students and what I'm using but I upgrade what I do it with. I use the newest or like I'm not going to say you've got to have this film or a film strip, you know, instead we'll find something similar on the computer and do it that way. But I might still have the same lesson but now I'm doing it now with a different piece of technology. (208)

> Despite her affinity to the newest or the latest technology, Peggy also

acknowledges that new is not necessarily better. When discussing the evolution from reel

to reel films to DVD videos, she notes,

> I use them [videos] once in a while but never a lot. And I actually found that when I first started here there were better things or at least I found better things on the reel films because they were bought specifically for the school and when it came to VHS and DVD we didn't have the resources any more. And nobody was buying those things like they were before so it was like I had to go out and buy my own if I was going to so I pretty much I haven't used those. (222)

When email as a standard for dissemination of staff information finally arrives, Peggy is

elated; to her this is a signal that her school is finally moving forward.

> I'm so excited about this year because this is the first year they started using email. Really started doing the update on there; using their web pages. And to me it was like a giant step forward and the fact that the principals are doing that to me by being role models, by modeling it they are kind of encouraging it. They're sort of forcing people - if you want to know what's going on you better go online because otherwise you're not going to know. (351)

But she is still frustrated by the snail's pace of both the school and the district when it comes to encouraging or perhaps requiring the integration of technology. "And I do like some of what's happening in technology but it's very slow and it gets frustrating (60)."

As with the other teachers we talk about the innovations or technology changes she has seen in her tenure in the classroom. Her fearlessness is apparent in her response to a question about anything that she might have avoided over the years.

> I can't think of any of them that I avoided because most of the time I was begging for this stuff. You have to understand special ed teachers are kind of on the bottom of the totem pole. We're right there with elective teachers if you want to understand, you know. You know everything comes to the core teachers first and they'll be given something and then the rest of us are kind of there going, okay, I want it, I want it, too. You know, let me do this and so I've pretty much embraced ... I can't think of anything I've said nope, I'm not going to do that or I don't want that or whatever. I pretty much. whatever came along, I wanted to use it or try it or do something with it. (212)

Peggy should be the "knowledge broker" in her building because of her ease with technology and her experience as an Intel Teach to the Future Master Teacher. However, she seems to have little opportunity to be heard and often must acquiesce to the content teachers. As a special education teacher she has fallen victim to the new state guidelines that limit the dedicated time she has with the students she services. Now her days are relegated to functioning as a resource teacher within the classroom of a content teacher. This situation does not allow her to make decisions about how technology might be used within a given content. On the other hand, she does have an opportunity to see what other teachers are doing in their classrooms. Her observations are revealing about other experienced teachers and their use of technology.

> I'm mostly team teaching so I don't have a lot of control of what's brought in so I don't have control of a lot of that stuff. I mean my first hour and even my fifth hour I'm supposed to be doing this computer program with them all the time so I don't have a lot of say and a lot of ability to do as I'd like. (226)

Presenters were recently purchased and mounted on the ceilings at Yardley, and Peggy

comments on how this innovation has been received by experienced teachers. Of one

teacher on her team she observed, "... and she has a presenter but I have no idea where it

is. She's never brought it out (128)." She continues by relating a conversation she had

about the cost of mounting projectors, "I wanted to know how much because I believe

that ML and FT both would use theirs [*the data projectors*] if they were mounted and

they are not using them (146)."

> The people who have the presenters mounted in their classrooms are more likely
> to use them than the people who have them on a cart. Because they are there all
> the time and all you have to do is click something on and if you find something on
> the computer and then you can show it to the class. It is so easy. The people who
> have them on a cart don't want to leave them on a cart and so then they're worried
> about it and everything and so therefore they don't use it.(122)

> She goes on to discuss how another senior teacher has changed how she uses

instructional technology in her classroom.

> BK does a Jeopardy game on the computer where the thing appears you know the
> answer. That's pretty cool. She does diagramming. She does a lot of different
> things on there. (304)

> But today she did a Bill Nye video that was on the computer so she could click on
> the computer and it went with what we were doing. And that's what's so cool.
> You get that United Streaming and some of those videos and they go right with
> the lesson and you can just click on them so you can see them. And they're not so
> huge they're going to take up the whole class period but there's enough that it
> teaches them what it is that you're trying to get across. She used a lot of that.
> ML uses things we're using related to The Cay in there also. You don't know
> what a U Boat is, so okay, we bring up a picture of a U Boat and show them what
> it is and everything so they understand what the story's talking about. And so
> she's been doing a lot with it lately, probably no technology before the last 3
> months, no, the last 3 weeks. (312)

She is, however, bothered by the lack of communication among her colleagues.
We have been discussing the presence of video disc players in the science classrooms and how though in use for many years are virtually unknown to other staff members.

> And part of it is some of this stuff, nobody knows about it. For some reason nobody's told anybody about it. It's in the building but some people protect their things so if they have it and they're using it they don't share it with anybody else and let anybody else know about it. (180)

This breakdown in communication about technology issues is similar to Zina and Cathy's concerns about where to get information about using technology. There is no forum in their buildings or in the culture of their buildings that makes it possible to effortlessly learn of the successes or failures of your colleagues when technology is involved.

A primary concern for Peggy is that her students have a lot of exposure to technology because "kids really need to make it in this world because technology is the thing and if you're not going to pay attention to that and you're going to stay with old stuff – you're going to have a hard time (58)." During the early years of her career her students' use of technology was fairly typical following the pattern of most educators.

> You know, I have always had technology in my classroom since I started. I just have more now. I use more. I just never used it for lessons before. When I first started it was for them to play a game when they were done or things like that. And of course I used it for word processing. But not like I do now. (100)

Today her students "are actually on the computer doing things with it for projects and stuff. Whatever it is that I ask them to do (100)."

If you visit her classroom today, you will find students using her classroom computers when they see a need for the completion of an assignment. The technology has become more fluid and 'natural' as a part of the learning process. However, this is a relatively new phenomenon since despite her nineteen years as a classroom teacher Peggy

only began integrating technology within the past six years. Because, she has always had computers in her classroom since the beginning of her teaching career, the change to integration seems a long time materializing. She explains, "When I came to *Yardley*[2] I had to fight to get a computer but I have had one in my classroom every year and I always wanted to have one. Every year I applied to get a computer and I got as many as I could get in my classroom for my students to use (94, 96)."

For Peggy, the apprehension at times is connected to how much technology she uses in her classroom. "Am I just doing it so I can say I'm using computers? Is it something that really needs to be done on the computer (288)?" But when she explains how she uses the technology in her classroom one wonders if she is being to critical of her choices.

> And the thing is people get hung up on – okay, I'm making them do a PowerPoint so therefore I'm using [technology] … and PowerPoints are a way of using technology but there needs to be a reason for them doing that. And if they could do the same thing by writing it on a piece of paper then I'm not sure that that's valid. You know, it's like it needs to be something like showing them an actual hurricane happening. I can't do that without technology. I need to be able go on line and get it. I can't make a hurricane in my classroom so they can really see the force of it where they can see it if I can put it up there for them. You know, and so I'm not just using technology to use technology, I'm using technology because it helps my class. It helps to make them understand things. And that's what I struggle with sometimes. I mean, I want them to use computers. I want that, but I always have to ask myself is this really … is there a purpose to it? (286)

Her worry is that she is uncertain about "appropriate" uses of the technology that really create an advantage for learning and not just a fun thing to do. To me, the fact that she knows to 'worry' about her choices confirms her understanding of what it means to integrate technology.

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[2] Not the real name of the school.

Peggy has embraced almost every innovation or form of educational technology that appeared during her career. She talks about the evolution of something as simple as how teachers handled the task of reporting attendance.

> You know we went from ... nobody having computers to everybody having computers to doing our attendance sheet each one individually that we had to send down every hour and our attendance book. And we had to actually put the attendance on the report card ourselves and everything to the school doing the attendance on the computer ... to now we do attendance on the computer completely. (156)

For Peggy it is very simple,

> Whenever they come with something that might change how you can teach and just change how you look at things I fight for it because I believe that change is good. You've got to keep up with what's going on. (162)

Nothing has been too complicated for her to at the very least attempt. During our interview she complains of being stumped by one particular piece of equipment she would really like to use. She is not intimidated by this equipment just unable to find the time to troubleshoot what should be a simple connectivity issue. She longs for some time in her day to prepare for the use of technology. It requires time to learn new programs and how to use new devices just as time is required for preparing to teach new content. She would appreciate the gift of time from the district for learning to better use the technology she has available.

### Fear of Failure Resolved

I am not sure how I came to know Zina. I do recall being in a series of workshop where she served as one of the facilitators. We did not have much contact then so I am guessing that our first meaningful meeting occurred at the first Intel inservice. As educators we know that some students over the years just stand out for us. I think this was the case for Zina. Her learning style and her need to know the details meant she was

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never reluctant to ask questions or insist that clarity prevail. When we sent out notification for the second Intel inservice, she appeared without prior contact and responded to our surprised greeting that if we were doing another Intel as an alumnus she certainly knew she was welcome and indeed she was. More importantly, her appearance meant she truly wanted to learn how to use technology more effectively in her classroom.

With the additional four or five years behind her, Zina's use of and her attitude about technology have become more firmly established. For her it drives her teaching and she is more conscious and deliberate about making technology a part of her teaching and her students' learning. She is more comfortable, feels more confident, and has learned how to cope with the fear she mentioned in the earlier chapter. The most remarkable thing about this new Zina is her ability to understand her fear and use it to her advantage.

Zina's fear now has a name – fear of failure and having others know you have failed. As the self proclaimed perfectionist, she now understands her need to be known as the person with all the right answers. "I know that people perceive me to be intelligent so I can't let them know that I might not be (262)." There is the constant pressure not to make mistakes that others will see though she understands that mistakes are always a possibility. "I can't be wrong, okay? I can't make mistakes and I do (260)," she says. As a perfectionist she is reluctant to explore new things. There needs to be a period of private circumspection where some degree of understanding and confidence can be acquired before she is willing to be public with her knowledge. Perfection and the unpredictability of technology create an untenable mix for most of us and with Zina the mixture is more disconcerting.

I have to chew on things a long time and build up my confidence and know that when I do it it's going to come out somewhat the way I want so because of my fear of making mistakes I postponed using technology. (52)

Zina further clarifies how her need for perfection influenced her delay in embracing the technology she now uses whenever she can include it in her lessons.

I don't like to make mistakes and fail. And this is so new and so indiscernible. I don't know … how the hell does that go from one place to another and carry those images and make those sounds and bring me that information? I don't have a clue how that works. But I don't have clue how the TV works either. But I grew up with that. This is new. It makes me feel stupid so I don't like to be afraid, I don't like to be anxious, I don't like to feel stupid. So I think those are … that's the combination, the trifecta. (212, 214)

For Zina two iterations of the Intel course, a technology related research project, and an intense course for her master's program had to be in place before she felt confident enough to finally say, "I think I can do this (52)."

Isolation has also played a part in her fear as she explains here:

I was reluctant to ask for help from the middle school staff and I always thought if I was in an elementary building where you stick your head out in the hall and say – hey, can somebody help me with this? That would have helped propel me past that fear a little bit more. But I needed the crutch of somebody being nearby who could extricate me if I got in over my head. (54)

But today, Zina has reached a point where she in confident, though cautious, and more willing to not only introduce new technology to her class but explore unfamiliar territory. It's an evolution that is evident by some of her comments.

So I'm feeling much more confident and the more confidence I have and the more practice I have with the programs the less fear that I have. (74)

I feel like I am no longer on the outside looking in, but I am not at the head of the pack. I am trailing along the fringes running as fast as I can. And maybe I've even moved a little bit to the center of the crowd, but I am not there. And just when I think I am, the iPhone comes out, you know. My own children know tons more than I do about how things work. (112)

Yes, and another thing that I found that it helps me overcome is I'll say to the kids, who knows how to do this? (120)

In order to maintain this image of understanding around her peers, Zina points out how her personal learning style has been influential in her ability to more forward and gain confidence.

> Zina: So I found for me, and I don't know if it's technology that has changed me but I used to read voraciously. I'd get something [*new*] and then I'd read about it. You know, get a television I'd read about it. Now I want to be shown about it.
> Sandra: You think that's a difference in your learning style now?
> Zina: I do because the MP3 player, why don't I sit down and figure it out? I want somebody to show me. That's a difference but I can't explain why. But I realize that about myself. I think it's still that fear thing that I'm going to do something wrong. (188)

But, she goes on to explain, "Technology has complicated our lives. … It has complicated our lives and some times it makes me shaky (226)."

One of the goals for implementing technology in classrooms is to change the way teachers teach. When the technological knowledge is added to the pedagogical and content knowledge a new kind of teaching emerges. The technology allows teachers to teach differently and allows students to learn in different ways. Helping teachers to make and understand this change in their teaching requires a certain kind of preparation. Zina found the Intel course format to be instrumental in preparing her to comprehend both the technology and its integration into her content. She says, "I have to cogitate on things before I put them into practice (254)." And she continues to explain her need for additional support. "I didn't always get things the first time through … confidence-wise. So the best applications that impacted my teaching were the ones that I could gain confidence, try it out, try it out again and revisit (254)."

Perhaps more telling is that Zina, like some of the other experienced teachers, does not want to learn things in isolation. She needs and wants professional development activities that push her a bit outside of her comfort zone though the fear still persists.

> I need somebody to say you have to do it, you have to get it done so I can get past the fear. The fear sometimes blocks me. I'm not going to understand this. I don't know if I heard it right - those kinds of niggling thoughts. (256)

Today there is an air of comfort and confidence about Zina. In the five years since the initial Intel inservice she has blossomed. Technology has become more natural to her in the sense that creating lessons that include technology is what she does routinely. She is constantly looking for ways to use technology in her instruction and as an assessment product for her students. You can hear a note of excitement in her voice and our interview is filled with stories of progress and change. Even her colleagues see her in a new light and her pleasure is evident as she shares the compliment of being called a 'techie' after setting up a chat room. A colleague sends her a message that says, "I really like it since you set that up, you're so much more techie than I am (70)," and her confidence moves up another notch.

Zina now sees herself as moderately fluent in technology. She has a better sense of when to use it within her curriculum and is only hampered by her need to be well prepared before allowing her students to get involved. "I think I need to know something so that when things go wrong I can be the guide (346)." While she seeks ways to include technology she finds that knowing what is available and practical is difficult. Little has changed since her interview in Chapter Three when it comes to resolving the issue of being informed about technology. She still pretty much left on her own to locate good technology practices or learn about new technology tools. This lack of available

resources frustrates Zina because of her commitment to her students who often compete

with students from more economically advantaged districts. She eloquently explains how

her students drive her to do more and do it better.

> What pushed me into – okay, I have to do this is for me because I asked myself a question. What is it my kids need to prepare them for the world? Because these are our district's best and brightest children and if they had a teacher who was reluctant to live in the 21st century then I wasn't preparing them. Then I wasn't preparing them. I wasn't giving them the skills they needed. When they go to Young People's College or Saturday School at [*local community college*], they run into the best and brightest from other districts and I wanted them to be equipped. So really that was what finally pushed me into – I've got to do this. I've got to find a way to make it work. So I've sort of … it was asking that question - what do my kids need that the answer came from – technology. That is what they need. That's the piece that was missing. So I could teach them to be thinkers. I could teach them to read and write, but everybody can. And they were ill equipped to compete with the kids that they are going to come up against in college and high school and all of those other places, all of those other venues.

More problematic is that Zina's social network of resources to sustain and

enhance her knowledge of instructional technology has diminished. Her additional

knowledge comes from asking questions, lots of questions, of others but not in any

formal sort of manner. One colleague assures her that her queries are welcome by being

accessible and offering a smile when she is approached. Zina expresses the inadequacy

of this arrangement when she talks about a project she would like to implement the next

school year.

> Next year I want to make a documentary. We're studying immigration and I want them to make a documentary. I don't know how to run a camera. I don't know how to make iMovies. I don't know a lot. So we might be doing a timeline next year. But I would like to make a documentary. (334)

If she can not find a resource to come in and show her how to do what she needs to know,

Zina is willing to use part of her summer break to take a course. What is risky is finding

a course to meet her needs and her learning style. If she is unsuccessful in both areas, her

students will miss an opportunity to learn a number of skills and content in new and different ways.

Zina does not allow the scarcity of equipment to hamper her efforts to use technology with her students. Though she feels limited, she has an advantage over most teachers in the study. She has four computers in her classroom plus a teacher's station. She uses a teaming concept to rotate her students when using the technology.

> It's hard for me to use technology in here. I have four computers but I do it because I want the kids to have it. I spend a lot of time figuring out, okay, if I could get them here for 20 minutes what could they accomplish, what can I have the other kids doing while they're waiting their turn. So really technology has become the hinge pin for my teaching not just an add-on. (268, 270)

When her projects require more extensive time with the technology, she has coordinated time with the principal to use the middle school computer labs. She has managed to learn how to use the school intranet to access files stored while students are in the labs. I find this revelation amazing since most of the teachers I had worked with over the years had a great deal of difficulty understanding how to move files across the network. That Zina now does this with such ease and assurance lets me know that she has managed to master more of the nuances of technology than she realizes.

As with the other teachers, we discussed innovation in educational technology. For Zina the dazzler is the transition from mimeograph machines and cutting stencils to the latest copier with color printing and a variety of other bells and whistles. "Copy machines and copy machines that print in color and collate and staple. Not just copy machines that you have to put in one and then turn it over … that do two sides; that make books. That does it all. That also keeps track of how many copies you've made (144)." Next in terms of the awe factor would be the ability to play videos impromptu from the

Internet. She appreciates being able to say to her students, "Oh, look, we were just talking about this yesterday. I found this and I want to show you what a shadoff really looks like and it's an irrigation device that the ancient Egyptians used (162)."

I am surprised to learn that Zina found the computer to be a must have tool for the second graders she taught 13 years ago. She admits that, "I didn't have a plan for that computer time (180)." As emblematic of the evolution of technology in the classroom, students were allowed to defer an assignment for drill and practice activities. As an educational innovation she embraced the idea of students using computers as a tool for learning but not as an instructional tool for her own use. She explains her thinking at the time this way:

> They had three choices and that helped the kids. It was leverage for me because you could lose your computer time. And it was exciting to them to give up one piece of the day and be able to go to the computer. So I can't say I didn't embrace it but I was fearful of teaching it. (180)

Zina's viewpoint on instructional technology is both refreshing and promising. When I query her about how she perceives the role of technology in today's classroom her response is straightforward;

> I think it should just be part of the fabric of the classroom. I don't think it should be something you think of last. I think it should be integrated into everything – someway or the other. For me it's easier because I only have two subjects to integrate. And I don't mean ... a lot of times when you integrate - and math is a good example - because a lot of times science and social studies and language arts can be meaningfully taught in an integrative unit. But when you ... it's like, well, I've got to have some math. So they throw in some math that attaches itself somehow. I don't think technology should be like that. I think it should be infused throughout.

Though it sounds easy enough, Zina is the first to admit,

> I try to do what I can. Sometimes I'm still held up by my own worries about it but I ... and I don't think ... I mean I don't know programs so don't think

programs ... I do, even though I say it should be infused, I have to work at infusing it. (380)

And I don't think I'll ever catch up. I'm going to keep running as fast as I can and it's way beyond me. I mean every time I get a handle on something, there are 42 other applications that I don't know about. (382)

### *Making Sense of it All*

Without attempting to speak for all experienced teacher or proposing to create any generalizations about experienced teachers, I believe that while individuals, they are not unique among experienced teachers. My summative conclusion would be that we could find Cathys and Peggys and Zinas in school districts across the country whenever we choose to question the degree of technology fluency of the nation's teachers. Knowing that they are not alone in their endeavors helps us understand what other teachers face in order to develop and increase their level of technology fluency and efficacy for the sake of their students' learning.

What follows are the points I found most instructive.

*When Retirement Looms* - The closer to retirement we find experienced teachers; the less likely they may be to seek out opportunities to increase the use of technology. Huberman (1933) describes this close proximity to retirement phase for some teachers as one of disenchantment where senior teachers begin to withdraw and view policy decisions in less favorable terms. Cathy's choice to give up further efforts is influenced by her decision to retire in the near future. Her reaction to being forced to use email without formal instruction has created a begrudging acceptance rather than an attitude of progress. According to Huberman, teachers nearing retirement are often perturbed by policy decisions that place them outside of their comfort zone. Cathy feels, and perhaps rightly so, there is little time left for her to reach a level of competency that will benefit

her students.  Any gains in fluency will come after retirement when the learning will be on her terms and for her pleasure and benefit.  The challenge is to find ways to assist senior teachers earlier or pair them with teachers known to be comfortable and successful users of technology thereby providing a balance to make sure students have opportunities to benefit from learning with and through technology.

*Believe it or Not* - An underlying current in these stories is the need for teachers to believe that technology is of some benefit for their students.  Peggy and Zina use technology because they believe their students need to know how to use it in order to be competitive.  The world that their students live in will be filled with a variety of technology and those who are prepared for the information age will be better equipped for success.  These teachers, though working in a lower socioeconomic urban district, want their students to be in position to compete with students in any economic class.  Finding ways to validate the benefits of technology as a part of the instructional process may be what some experienced teachers need to encourage them to become more fluent and better prepared for technology integration.

*Learning Styles* - Teacher learning style, prior knowledge, and comfort level influences how the teachers in these cases are able to progress when innovative ideas and tools are presented.  Cathy's difficulty with technology, aside from issues of trust, may stem from her need for individualized instruction.  At the very least, she needed more instances of modeling how to use technology in her classroom.  She is not secure enough to introduce new technology tools in her classroom without first seeing it and then demonstrating her competency to someone with more knowledge and skills.  Cathy's vision of what can be done with technology was very limiting.  She struggles to see the

bigger picture before being ever getting to the details of actual integration into her content and teaching. Technology played a very small part of her daily life complicating the transition to using it in her classroom.

On the other hand, Zina's inquisitive nature and her attention to detail compensated for her limited knowledge about technology. Because she wanted to learn the details of how things worked, she was able to see the possibilities for use with her students. With her students' best interest as a motivator, she was eager to explore ways that her students would enjoy learning through the use of technology. Despite the willingness and eagerness to learn more, Zina discovered a change in her personal learning style that veered away from reading for knowledge to the desire for more direct or live instruction until she felt confident enough to be left on her own. She attributes this need to be shown how to do things to her age. Perhaps more research needs to be conducted about how professional development for second half of life (Cohen, 2005) teachers should be structured. Are the structures we use to inform newer, younger teachers as effective for teachers like those in this study? Although Cohen dismisses the theory that older people have more difficulty learning, it may be that older people need to be taught in different ways.

For Peggy, altering her practice to adapt technology was relatively easy. Her prior knowledge and her personal interest in technology allowed her to move forward once she understood how to blend her content knowledge with her technological knowledge. She was ready to do more but did not have a sense of how to make the technology work with her content and her pedagogy. The computers she had in her classroom already served a valuable purpose for her special education youngsters. They

often needed more practice and more repetition to help them sustain knowledge often illusive because of their inherent learning obstacles. Combining content knowledge and technological knowledge is not something Peggy thought about to any degree until introduced to Intel's Essentials Course as an Intel Master Teacher. Learning how to build technology infused units was the piece she needed to become a true integrator of technology. Once the new technological knowledge blended with her content and her pedagogical knowledge, she was able to present TPACK (Technological Pedagogical And Content Knowledge) or the 'Total Package' described by Mishra and Koehler (2008) to her students with very little effort.

*Extended Duration* – I found that if given enough exposure or time to learn about infusing technology in their content, teachers could begin to change their practice. Intel's extensive professional development was beneficial for Peggy not only by introducing her to integration but also by allowing her to use her existing knowledge to help other teachers. When we think of the personal growth required when facilitating the learning of others, Peggy managed to ingest over sixty (60) hours of inservice time. The more she needed to instruct or assist other teachers in finding their way during an inservice, the more she reinforced the knowledge she needed for her own pedagogy and content.

Zina managed to invest an abundance of hours over a period of years. With two sessions of Intel, participation in an online learning workshop, and a master's level course, she spent almost eighty (80) hours dedicated to the use of technology in the classroom. When we consider the number of hours practicing and preparing for working directly with her students, she could only become more effective and proficient. The

question that remains is how can we provide all teachers with the amount of time these teachers invested to assure greater levels of fluency for more teachers?

*Knowledge is Power* - What bothers me most about these teachers is their sense of powerlessness when it comes to knowing how the technology should or could be used in their content. Zina and Peggy are eager to use technology and though Cathy has given up trying all three find themselves in same predicament. What is problematic is the lack of knowledge about *what to do* with *which tools* and how anything technology related might be effective and beneficial. None of the three could see the potential for a variety of educational technology tools because they did not know what was available. If something new is available that has the potential to enhance student learning, nothing is in place for them to learn about these innovations or other more pragmatic applications and how to include them in their classrooms or their practice. Zina and Peggy were willing to try things or explore the possibilities but only when they happened to hear about it from some undefined source.

Teachers will continue to wander through the morass of instructional technology alone and confused until deliberate concerted efforts by district administrations alter the situation. Technology can not continue to be an afterthought to be included by a few teachers who manage to take their personal passion or interest into the classroom. When we consider how ubiquitous technology is in our day to day lives, it becomes clear that few professions are untouched by some form of technology. Schools and classrooms should not be a technology free zone.

*Take me to Your Leader* - Each of these teachers has given us a clear message about helping experienced teachers over the hurdles of technology fluency. When I talk

to seasoned teachers the refrain is always the same – we do not understand technology and need someone to show us what is available and how we can use it in our classrooms. Without some kind of structured guidance, feedback, and modeling this group of teachers will continue to struggle in their efforts to become confident, secure, and effective when using technology in the classroom.

While this study does not include the role of administrators in helping teachers find their way to technology fluency, I did ask these teachers about the instructional technology philosophy of their principals. None of them has an unambiguous notion of the expectations of either principal about the use of technology. At best each teacher feels she is not prevented from including technology if she decides to use it. Conversely, none of the teachers feel an expectation from their principal that technology will be included in their teaching. Other than Yardley's move to email for distributing information to the staff, technology is not viewed as a concern or requirement for teachers or students. The implicit message is that educational technology is not important. For those prepared to explore, experiment, or venture out on their own, no one will interfere but also no one encourages or prepares for the possibilities.

In the chapter that follows, I will propose how changes in professional development, especially when it is related to technology, might assist teachers in becoming more fluent in technology.

# Chapter 5

## Shifting the Professional Development Paradigm:
## Coaches, Cheerleaders, or Both

In the previous chapters we heard from experienced teachers as they related their journeys toward technology fluency. Their stories ranged from hopelessness to signs of promise for change to benefit their own professional growth and enhance the learning of their students. They tell stories of how the use of technology produces fear and distrust. They offer explanations for decisions to refrain from using technology as their careers are ending. For some, they reveal nuggets of hope and adventure after spending hours in technology related professional development events. Understanding is their path to change and many look forward to learning with and from their students in new and different ways. Most of the teachers attempted to find ways to enhance their own learning in order to increase student achievement through the use of technology. For many of these and other teachers, they will continue to face students who are comfortable with technology and use it regularly outside of the classroom. Something must be done to facilitate the preparation necessary for attaining and sustaining technology fluency for the nation's experienced teachers even though we realize not all teachers will fulfill the goal.

We must be mindful that some teachers may never embrace this idea of technology fluency. The goal may be jeopardized by teacher apathy, lack of motivation, an unwillingness to change, or the complexities of the technology in and of itself. Janine and Cathy are prime examples. For Janine the timing has never been right for pursuing enough knowledge to comfortably add technology to her repertoire. Despite several

interventions, Cathy has essentially given up because what she believes would make her successful is not available. While this chapter focuses on issues of policy to provide guidance for the kinds of professional development programs that can promote changes to teacher practice, recognizing that even these may not be the solution for everyone is also important. The challenge becomes how we can effectively move from empirical examination of people and the problem to issues of policy as possible solutions. I address this issue of moving from people to policy in the last chapter.

Therefore, this chapter moves out of the realm of empirical research to considerations for policy decisions necessary to alter the present circumstances. The goal of this chapter is to examine the conditions under which professional development related to technology would be most likely to help veteran teachers incorporate technology into their instructional practices and improve student learning. In particular, I argue that many veteran teachers are more likely to utilize technology in instruction when they participate in professional development that is 1) extensive - of longer duration, and intensive, 2) concentrated and highly focused, 3) structured for active learning, 4) collaborative and collegial, and 5) prepared to include some form of ongoing support from a "knowledge broker" such as a technology integration specialist and/or participation in professional learning communities or networks.

### Background

In January of 2005, the Secretary of Education presented the National Education Technology Plan (NETP) to the United States Congress. The NETP identified a significant gap between students and teachers in K-12 schools in the area of technology. In particular, the report found that many teachers had substantially less knowledge and

skills related to technology than their students and that many teachers were ill-prepared to include technology into their instructional practices. Responding to requirements in No Child Left Behind, that all 8th graders become competent in technology, the NETP called for an increase in teacher training and professional development opportunities to raise the knowledge and skill levels of the nation's "technologically challenged" teachers.

In 2000, the National Center for Education Statistics (NCES) released results from a study of 2,000 schools across the nation (Smerdon & Cronen). The study reported few experienced teachers, though 65% of the total participants, identified themselves as being skilled in using technology in their classrooms. This left new teachers, the remaining 35% of the study, to categorize themselves as being well or very well prepared to use technology. With such a disproportionate number of teachers able to provide students with technology rich curriculum, many students would be left with little chance to acquire the technology skills the National Education Technology Plan views as desirable. These veteran or experienced teachers will, nevertheless, share the responsibility of developing the technology skills of eighth graders and providing students of all grade levels with technology rich experiences.

Because data has revealed large numbers of the nation's classroom teachers are not prepared to effectively integrate technology, the requirements of No Child Left Behind (the 2001 federal legislation and the goals of the National Education Technology Plan are not likely to be met according to the existing timelines. Further, because the focus and direction of NCLB has been on meeting the need for highly qualified content teachers, little attention or emphasis has been given to the technology requirements of the NETP or NCLB. Preparing eighth grade students for technology proficiency is not likely

to occur especially in areas where dedicated computer or technology teachers are solely responsible for providing students with the required skills. K-8 content area teachers, veteran and new teachers alike, will need to be involved to achieve the technology related goals of both policies.

The overall focus of NETP is directed, much like No Child Left Behind, toward ensuring the skills of teachers are adequate to support student learning. NETP referenced data explaining the growing use of technology by students (NCES, 2003) and highlighted various programs different states and districts have used to augment instructional programs by integrating technology. Relying heavily on data from student participation in Speak Up Day for Students, NETP asserted that "Today's students are very technology-savvy ... and rely upon technology as an essential and preferred component of every aspect of their lives (p. 9)." Conversely, the data show these students view their teachers as unprepared suggesting that "... teachers should be required to go to a technology course ... because our teachers are falling behind the students, as they aren't good with computer programs and software (p. 9)." By 2007, student participants in the Speak Up survey (Project Tomorrow, 2008) continued to identify teachers as an obstacle for the use of technology in the classroom. Students, especially in grades 6 – 12 mentioned their teachers "since it is the teacher who increasingly is limiting the 'when and where' of using technology at school (Net Day, 2007, p. 7)." NETP identifies the basic problem not in terms of lack of available funds, but in terms of the nation's teachers and their "lack of adequate training and lack of understanding of how computers can be used to enrich the learning experience (Patrick, 2004, p.10)."

NETP recommendations include the updating and expanding of infrastructure resources, the training of school leaders to understand the role and benefits of technology, and the reallocating of existing funds to meet the policy recommendations. The directives for teachers included professional development activities in the area of online learning, the use of data to provide differentiated instruction, the use of e-learning to supplement student learning resources, and the use of online resources and content including digitized textbooks.

One of the important goals of NETP is to increase the human capital of the nation by supporting young people as they prepare to enter a society and workplace entrenched in technological innovations. NETP points out the conflict that exists between the role and use of technology in business and an educational system that has failed to mirror the world of work. The concern is that teachers are not keeping pace with students who are exposed to technology at younger and younger ages. Both No Child Left Behind and the National Education Technology Plan expect teachers to be well-equipped to infuse technology into their curriculum to enhance student learning.

Because NCLB and the NETP policy recommendations desire high levels of competency in technology for the nation's teachers, I argue that teachers need high quality professional development which extends beyond mini workshops and one-size-fits all inservice experiences (Borko, 2004; Little, 1993; Cohen & Hill, 2000). To gain fluency in technology, teachers need to have access to knowledge brokers (Oldham & McLean, 1997)) and collegial expertise (Zhao & Frank, 2003) with high levels of technology skills. In this essay I describe how technology skilled knowledge brokers and professional learning communities or networks can provide opportunities for teachers to

develop and strengthen teaching practices that merge technological, content, and pedagogical knowledge or TPACK (Koehler & Mishra, 2005) which can lead to enhanced student learning.

This essay focuses on how effective professional development, knowledge brokers, and awareness of social networks might address ways to expeditiously prepare the nation's experienced teachers to integrate technology into their classrooms and satisfy the policy demands of No Child Left Behind and the National Education Technology Plan. In the first section, I review a framework of effective professional development that can support how teachers acquire the technological knowledge to complement their content and pedagogical knowledge. In the section that follows, I explain how notions of knowledge brokering and social networks could provide a theoretical base for supporting the professional development framework. In the next section, I elaborate on models that can be used to promote and sustain changes in teacher practice related to technology integration.

### Framing Technology Related Professional Development

Delivering professional development to meet the requirements of the NETP should involve more than providing teachers with basic Internet or computer operation skills to complement existing curricular resources. These are but foundational aspects for creating technology rich components that can lead to changes in teacher practice and enhance student learning. Figure 1 depicts the role that quality professional development can play in assisting teachers in integrating technology with curriculum and pedagogy.
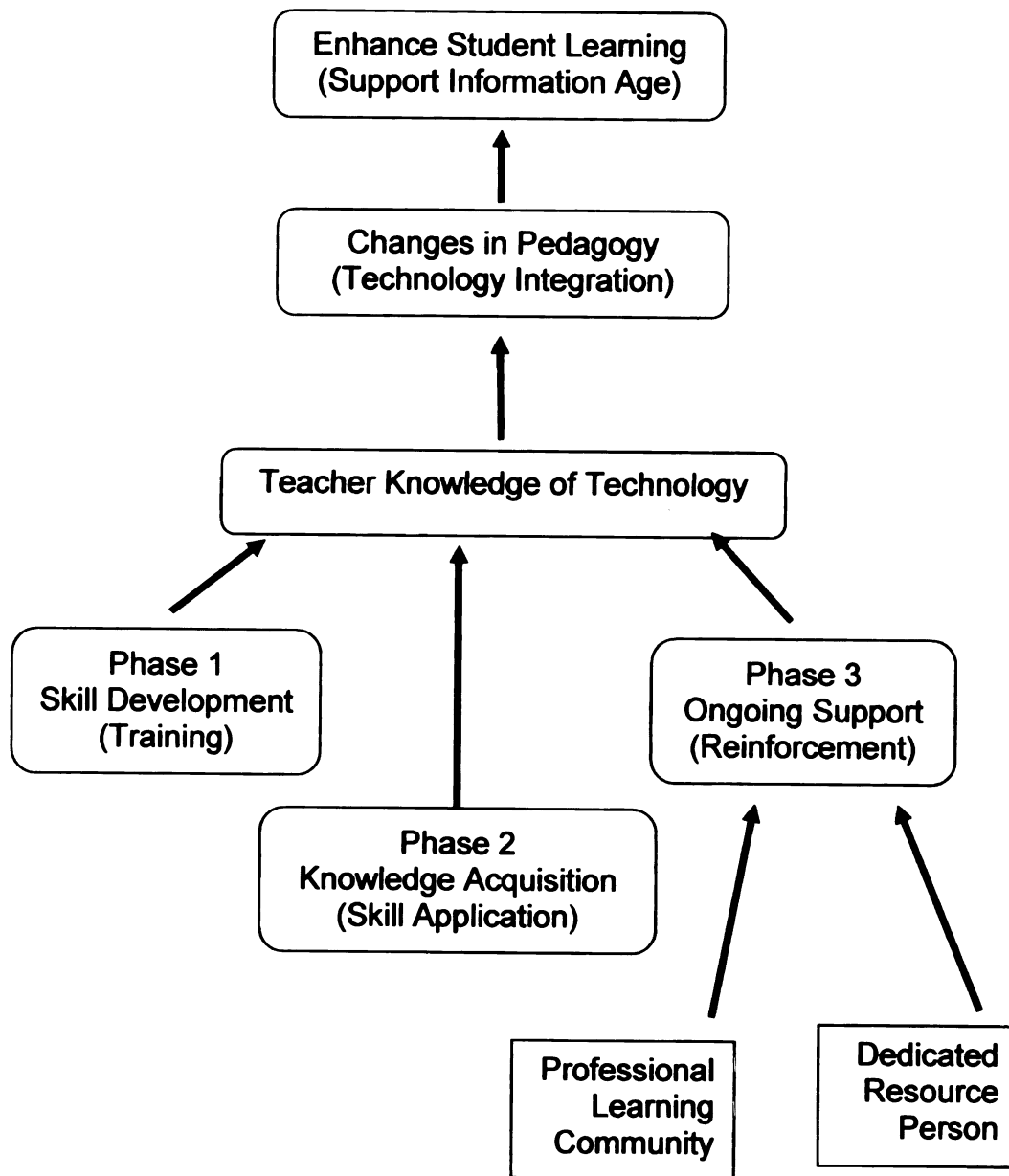
Professional Development for
Technology Integration

**Figure 1 Framework for Professional Development**

As indicated in the framework diagram, (Figure 1) the primary goal of technology integration is to enhance student learning and build human capital for today's post-industrialized society and technology rich workplace (Hargreaves, 2003; Patrick, 2004; Technology Counts, 2005). Since technology integration refers to the infusion of technology in the curriculum, content area, or subject matter, teachers will need to acquire new skills to meet this change in pedagogy and accommodate changes in the culture of classrooms. Rather than isolated technology related skills such as the creation of a word processing document or the ability to save and retrieve files, technology integration utilizes simple to complex technology related skills to support the learning of subject matter or instructional objectives. Combining Internet research with desktop publishing to create a newsletter exhorting the injustice of taxation without representation is but one example of technology integration. Creating this desktop publishing product may be one of many technology components melded in a unit of the causes of the American Revolution. A process for students to collaborate online while preparing such a newsletter can lead to changes in classroom dynamics and the practice of teachers.

Changes in pedagogy occur when teachers use future workplace "information age" (Hargreaves, 2003) skills and knowledge to present and explore concepts in a given curriculum. These changes in pedagogy can only take place when teachers themselves move from using basic technology skills to expanding and applying those skills to acquire a deeper understanding of a variety of technologies. Knowledge of digital cameras, personal data assistants (PDAs), animation software, and computers can be used to create meaningful additions to existing curriculum. This infusion of technology can change the way teachers teach and the way students learn.

High quality professional development designed to increase teachers' ability to effectively integrate technology is crucial for changing the pedagogy of the nation's teachers and the success of policies such as NCLB and the NETP. As illustrated in the framework (Figure 1), this professional development occurs in three, often cyclical, phases – skill development, knowledge acquisition, and ongoing access to professional learning communities or networks and a knowledge broker or dedicated resource staff.

*Building Individual Skills*

Phase 1– Skill development or Training, as depicted on Figure 1, occurs when professional development activities focus on singular or isolated sets of skills and is more cognitive and individualized for the learner. It is here that we find examples of the initial efforts to prepare teachers for using technology in the classroom which have been traditionally centered on training in the basic operation of equipment and the features of various software applications (Zhao, Pugh, Sheldon, & Byers, 2002). Inservice activities focusing on keyboarding, word processing, or spreadsheet features or techniques where teachers learn basic operational skills are examples of skill development or training. Inservice activities have often taken the form of after school sessions in how to create Word documents with centered titles and boldfaced words. Teachers were expected to take these basic skills back to their classroom and ultimately use them minimally for increasing their personal productivity. The cycle would typically continue as teachers returned for the next district offering designed to provide awareness of available technology rather than build knowledge to support effective integration. Frequently teachers found this newest exposure to software or hardware either too confusing or totally irrelevant to instruction and student needs leaving materials and techniques

languishing untouched soon to be forgotten (Cuban, 2002; Zhao et al., 2002). Student activities often did not include this new software because teachers, for example, were unsure of how to provide access to a single computer for all their students (Ertmer, 1999). This phase exemplifies the workshop approach to professional development often decried as being insufficient for sustained learning and change in teacher practice (Guskey, 1986; Hoban, 2002; Little, 1993). While basic skill workshops can benefit teachers by creating an awareness of technology, these scattered, after school or one day professional development offerings are usually not sufficient for assuring technology integration. These activities offer a basic how-to element without providing the knowledge needed to apply word processing or presentation skills to classroom activities.

The Skill Development or Training phase does, however, permit individual learning to occur since teachers often select inservice opportunities to support their personal deficiencies in specific applications or use of hardware. Unfortunately, teachers reveal little change in teaching practice with only an annual rate of 1 to 8 hours of professional development in a specific topic (NCES, 2002). For significant change to occur teachers need more extensive or longer periods of time dedicated to professional development (Birman, et al., 2002; Garet, et al., 2001) designed specifically to promote the infusion of technology into their content areas. Fortunately, this first level barrier (Ertmer, 1999) to technology integration has increasingly been overcome by many of the nations' teachers (Smerdon & Cronen, 2000) and is not the focus of the 2004 National Education Technology Plan, which seeks to move teachers beyond the basics.

## Knowledge Acquisition and Skill Application

Phase 2 – Knowledge Acquisition and Skill Application, as represented in Figure 1, occurs when professional development activities focus on converting isolated technology skills into more comprehensive techniques for developing and implementing student learning activities. The quality of professional development, in general, and its role in altering teaching practices can not be minimized. Researchers have identified several characteristics of professional development that are associated with teachers accepting and implementing changes in instructional practices that lead to improved student achievement. I, however, will elaborate on only four of these characteristics that are particularly important in order to expeditiously increase the technological knowledge of experienced teachers. These characteristics of quality professional development related to technological knowledge are a) the duration of the activity (Cohen & Hill, 2000; Desimone et al., 2002; Garet et al., 2001; Hoban, 2002:), b) the inclusion of active learning (Birman, et al., 2000; Borko, 2004), c) the focus on a specific content or topic area (Borko, 2004; Cohen & Hill, 2000; Hargreaves, 1999; Hawley & Valli, 1999; Hoban, 2002), and d) the element of collegiality or collaborative participation (Hawley & Valli, 1999; Hoban, 2002).

*Time for Quality* – Building expertise in any endeavor requires time to learn and practice. Professional development programs need to be of such duration that teachers have opportunities to learn, explore, and actively participate. The teachers in the previous chapters are prime example of this characteristic and their ability to increase their technological knowledge. When Cohen and Hill (2000) studied the effects of reform based professional development and changes in teacher practices for approximately 1,000

grades 2 through 5 teachers from 250 California schools, they found that success in changing teacher practice occurred when extensive time for content related professional development activities was provided. According to Cohen and Hill, teachers needed "... opportunity for substantial work, which could not occur in a day or a few hours (p.7)." These authors reported that increased learning opportunities increased the degree of changes in teaching practice and decreased the return to old practices. Little (1993) noted "Effective training has come to be defined largely by its ability to provide adequate opportunities for practice ... " (p. 132). Desimone, Porter, et al. (2002) include "extended duration" (p. 82) as a characteristic of "high quality" (p. 82) professional development.

Government reports on the status of education factors (NCES, 2002) and teacher professional development (NCES, 2001) found teachers themselves indicated more willingness to alter practices when more than eight hours of inservice was provided in a specific, focused topic. To acquire the skills needed to effectively integrate technology, teachers need professional development activities which provide extensive coverage of skills and topics for the "transformation of ideas" (John-Steiner &Meehan, 2000) and knowledge. This extensive coverage is time intensive and cannot be successfully administered in single session workshops or one day inservice activities. The value of the after school workshop should not be disregarded. Its benefit for skill building (Figure 1 - Phase 1) may be exactly what teachers need for exposure and awareness. If the goal is to build a technology skill, the one day professional development session, for example, on navigating spreadsheets may be appropriate and timely. Conversely, mastering techniques for integrating spreadsheets into science units requires a more extensive inservice experience. Programs like eMINTS, enhancing Missouri's Instructional

Networked Teaching Strategies, (http://www.emints.org), Intel Teach to the Future

(http://www.intel.org/education), and university based programs such as Michigan State

University's Educational Technology Certification Program

(http://edutech.educ.msu.edu/) are examples of more extensive professional development

offerings. These programs are designed to help teachers construct units of learning

appropriately infused with technology. They require longer time commitments and direct

teachers to focus more on content concepts while using technology to support curriculum

objectives or goals.

*Targeting Content* – When Desimone et al., (2002) studied 207 teachers in 30

schools investigating the effects of professional development on changing teaching

practices, they reported that to increase a specific instructional practice meant that

professional development "must focus squarely on that specific practice (p.91)." Their

findings indicated "professional development that focuses on a particular teaching

practice predicts increased teachers' use of that practice in their classrooms (p. 98)."

Cohen and Hill (2000) also reported that teacher practice is more apt to be affected when

student curriculum is the focus of professional development related to reform policies.

More than one teacher in the previous case studies reported that working to create a unit

of study that included technology helped them to see both the possibilities and the

benefits of technology integration.

Within this phase the professional development is more contextualized as teachers

prepare to merge technology with content or subject matter. Much of the time spent in

professional development will be needed to aid teachers in recognizing the various

technologies available and in understanding which technologies are appropriate to inspire

learning (Zhao et al., 2002) in a given content area. This phase also allows for more situative learning (Borko. 2004) and learning becomes a social activity especially when a concerted effort is made to target grade levels or specific content areas to create a connection for learning.

*Active Learning* - It is important that teachers are provided with active, hands on experiences that mimic student learning and increase opportunities for learning and understanding. Effective professional development is organized to assure that teachers apply what they are learning to student outcomes (Borko, 2004; Cohen & Hill, 2000; Hargreaves, 1999). Little (1993) describes promising forms of professional development as those that "engage teachers in the pursuit of genuine questions, problems, ... in ways that leave a mark on perspectives, policy, and practice (p.33)." Teachers, after all, as participants, also become learners (Borko, 2004) using skills presented in professional development activities in the same ways as their students. Teachers, like any other learner, need to be engaged in active and inquiry based learning (Desimone et al., 2002; Borko, 2004; Hargreaves, 1999).

*Collaboration and Collegiality* - Teachers in national surveys have identified professional development opportunities that include collaborating and collegiality as being beneficial to knowledge acquisition and instrumental in changing their teaching practice (NCES, 2002). Professional development programs designed to transform knowledge while actively involving teachers tended to include the same kinds of collaborative project-based learning elements teachers are expected to use with their students (Borko, 2004, Cohen & Hill, 2000; Hargreaves, 1999; Koelher & Mishra, 2005; and Zhao & Frank, 2003). Sugar and Wilson (2005) reported 92% of their respondents

preferred inservice technology workshops that included discussing, talking, and collaborating with other teachers. Desimone, et al. (2002) found professional development to be more effective when teachers from the same school, department, or grade collectively participated in active learning activities. This desire for collaboration and sharing with other teachers as a part of the professional development process was a frequent observation from the teachers in the previous case studies. Learning is situated and generally occurs in a social environment where learners share and acquire knowledge from one another. Most of the teachers in the previous cases expressed repeatedly the desire to confer with peers with some consistency about educational technology matters. None of the teachers, except perhaps tech savvy Peggy, expressed the desire to learn new technology related skills in isolation.

## *Ongoing Support*

Phase 3 – Ongoing Support (Figure 1) comprised of two elements, professional learning communities or networks and the dedicated resource person or knowledge broker, is likely to occur when teachers have access to one or both of these components. Ongoing support is often neglected once the initial, formal professional development activity has been completed. Professional learning communities or networks, located within the school social structure and those which are formed outside the school including virtual networks, such as educator led user groups or social networking sites, can be instrumental in keeping teachers informed of innovations in educational technology (Holmes, Polhemus, & Jennings, 2005) or other school reform programs (Hawley & Valli, 1999). Opportunities to share and collaborate across curriculum areas and grade levels can be both motivating and encouraging (Borko, 2004; Zhao & Frank,

2003). Teachers need opportunities to discuss successes and failures in order to perfect changes in their teaching practices. The increasing use of social networking sites such as Ning.com and Facebook allow teachers to connect with peers outside of their brick and mortar communities. The vulnerability that sometimes prevents teachers from revealing their shortcomings to colleagues across the hall can be avoided by communicating with strangers who become online 'friends.'

The second element of Phase 3 (Figure 1) is the dedicated resource staff person or knowledge broker. Referred to for our purposes as a technology integration specialist, this knowledge broker assists teachers in fine tuning skills introduced in the skill building or knowledge acquisition phases (Figure 1) of professional development. This resource staff or knowledge broker is available to assist teachers in converting professional development into practice. Regardless of the phase teachers have completed, the technology integration specialist is an onsite professional development resource. Assistance, coaching, guidance, and onsite professional development in solid technology integration practices is the primary function of this knowledge broker. Professional development literature, however, does not identify a knowledge broker as a function of quality professional development. In the following section, I discuss three professional development programs that have promise to be effective, especially for experienced teachers because of their focus on four of the characteristic mentioned earlier. That is they are 1) of longer duration, 2) highly focused, 3) based on active learning, and 4) collaborative and collegial.

### *Programs That Work for Knowledge Acquisition*

When Hadley and Sheingold (1993) studied teachers experienced in the use of technology, they found approximately five years were needed for teachers to become competent enough to effectively change their teaching practice to include technology. As we have seen from the teachers in the previous cases, teachers' lack of knowledge and discomfort concerning technology remains a barrier for independent exploration (Sugar & Wilson, 2005; Zhao et al., 2002). The complexities perceived by teachers in using technology (Ertmer, Addison, Lane, Ross, & Woods, 1999) indicated the continuing need for supportive, collaborative efforts to encourage continued learning. Teachers are often unaware of what to study or learn and are frustrated by the peculiarities of technology. As the learning curve swells the likelihood of continuing to explore the potential of technology use in the classroom diminishes. Three programs are examples for meeting the requirements outlined for effective technology related professional development. Programs such as Intel Teach to the Future, eMINTS, and university based programs require more hours of commitment for districts and teachers. These programs are also framed around a situated learning experience (Borko, 2004), where social activity is a part of the learning environment, for the participants and can be of benefit for teachers since expecting them to work at building skills and knowledge in isolation increases the learning curve.

Intel's international Teach to the Future program, for example, requires a minimum of forty hours of class time with a recommended additional twenty hours of 'homework' for participants (See http://intel.com/education). This program was used with the teachers in the previous cases and the author, an Intel Master Teacher, was the

coordinator and facilitator for two iterations of the program. The timeframe for this extensive inservice can vary from intense five day summer workshops to staggered scheduling during the school year. Kanaya et al. (2005) found the compressed schedule, that is course completion within 44 days, increased the probability of teacher use of technology rich units developed during the inservice and increased the potential for changes in teacher practice. The Intel Essentials Course focuses on the redesign of an existing unit to incorporate a variety of technology components. Grounded in the concept of an essential question, teachers focus primarily on using their existing pedagogical and content knowledge to flesh out critical questions designed with higher level thinking skills to challenge students. Once the content for each unit has been established, teachers work collaboratively to create technology rich products from the perspective of their students. These finished products can then be used as models to scaffold lessons when presented to students. Teachers, working together to hone their technology skills, come to understand the challenges their students face creating similar products and gain an appreciation for how lab and classroom environments are managed when integrating technology. The intensity of this program and the high incidence of active learning facilitates in establishing collegiality and collaboration among participants. Because the program mimics a teachers' own classroom content and environment, teachers are more apt to develop a sense of competency and confidence which promotes sustainable changes in practice. An additional benefit of this program's structure was that it allowed participants to see examples of how to present educational technology to their students. Because teachers became 'students' any problems or surprises that surfaced during instruction were defused by knowledgeable facilitators. When teachers realized that the

classroom environment did not collapse when minor technology glitches occurred, they felt more reassured that they to could be successful even if the tools were 'uncooperative.'

The eMINTS program, similar in design to the Intel program, includes over 250 hours of professional development for its first year program and includes some onsite follow-up resources for its participants. Since its initial implementation, entire schools in Missouri have invested in the program to meet the needs of their teachers and students. School leaders report increases in student achievement that they attribute to the eMINTS program (Bickman, 2005, Patrick, 2004; www.emints.org). Much like Intel, eMINTS uses a train-the-trainer model creating multiple levels of expertise within a school and district. Both of these programs extend the reach of ongoing professional development by including online professional learning communities to complement opportunities for teachers to share, communicate, and collaborate in less traditional (i.e., face-to-face) ways. Despite the extensiveness of these programs, teachers, as confirmed by the case studies in Chapter Three, returning to their classrooms still need coaching, encouragement, and support to implement the knowledge they acquire.

The eMINTS program, which demonstrates a strong commitment to technology related professional development, provides onsite support situating on going professional development within teachers' classrooms. On site support staff assists teachers implementing techniques learned in the initial eMINTS inservice and assists teachers in expanding beyond the skills of the initial training. With ongoing support come fresh ideas about new technology and new uses for existing technologies situated in the teacher's classroom environment and curriculum.

The Educational Technology Certification Program at Michigan State University is yet another example of technology related professional development where duration, collaboration, active learning, and content focus strengthen the potential for changing teacher practice. Structured as a series of three modules, participants meet face to face and online for over 108 hours of instruction. Teachers work collaboratively in content or grade level groups to create technology rich content and units of study for their classrooms. This university led course, open to a wide variety of teachers from various school districts, does not offer the ongoing collegial support programs of Intel Teach to the Future and eMINTS. Participants are less likely to have face to face contact once the course series has been completed, however, with the new direction toward virtual social networks the EdTech subgroup can now be found on Facebook, Twitter, and MACULSpace. This series of courses also has the requisite characteristics of effective professional development and, therefore, promises the success of its participants. As Kayana and colleagues (2005) found, the intensive and extensive features of this program promote collegiality and collaboration during the course. Teachers are more likely to use technology in their classrooms and their practice when they feel more successful as learners. In Chapter Four, Zina reported on attending one part of this series as being instrumental in the growth of her technological knowledge. It gave her the confidence she needed to begin her efforts to include more educational technology with her students. In the next section, I discuss how social networks and knowledge brokers can work to alter the existing framework for professional development by complementing programs like the ones in the previous section. Only in the eMints programs includes these two important ongoing support mechanisms.

***Shifting the Professional Development Paradigm for Technology Fluency***

***The Role of Social Networks in Professional Development***

In the midst of finding ways to help experienced teachers overcome the difficulties of becoming technology fluent is an appreciation for how teachers interact from day to day. Inherent in the school environment are elements of social capital and social networks that come into play when we question how teachers transfer knowledge and information. According to Coleman (1988), social capital stems from the social relations in an organization which are designed to support the needs and goals of the collective. Linking this idea of social capital to technology related professional development means exploring how certain actions by various actors within a social structure, like a school building, work to distribute or disseminate information and knowledge. It is the presence of social capital that allows for the sharing of ideas and the development of norms and sanctions which will benefit the organization in some way. In the case studies presented the value of most teachers' social capital was not always enough to support teachers' efforts to sustain knowledge about using technology in their classrooms. Too often the social network of a teacher in the cases presented did not include competent users of educational technology from which to garner new trends or strengthen existing knowledge. In fact, we could question the availability of technological knowledge within a school or the district as a whole. Certainly there existed some form of knowledge brokers, point in fact; I was at one time one of those with higher levels of technological, pedagogical, and content knowledge (TPACK) and frequently used my own social network to share information about technology in-services and classroom practices.

Consider the work done by Penuel and Reil (2007) to analyze the social network of schools in order to identify how information flows within a school. The results of their study mirror many of the comments from the teachers in the previous cases. Since a social network is defined as "a set of people and the relationships among them" (p. 611), any given school is bound to be comprised of large and small social networks based on any number of affinities. However, the experienced teachers in the previous chapters were unable to identify or connect with a network of other teachers, particularly in their buildings, where technological knowledge could be shared and where, as learners, they could move beyond their own limitations to grasp concepts by collaborating with more skillful peers (Vygotsky, 1978).

Penuel and Reil's findings reflect some of the same issues mentioned or inferred by the teachers in the cases. For example, the authors noted that who you talked to carried more weight than the number of people in your social network. Recall Zina's revelation that once the media person left her building she was unable to find a replacement who could provide the same level of knowledge that she needed. Penuel and Reil identified this as the loss of an 'expert' who could pass on teaching practices and additional knowledge. They also found that often it was necessary to leave the 'local' social network in order to seek out answers not available within the local network. However, the experienced teachers in this study were not familiar with knowledge brokers outside of their network. They repeatedly complained about not being able to find a resource to help them with new technologies or with how to use old technologies in new and different ways. From their study, Penuel and Reil realized that schools needed to make the experts more visible to other faculty members. As we have seen, knowing

who to contact is crucial for supporting growth in technological knowledge and school reforms in general.

Social networks can easily evolve into a professional learning community (PLC) where teachers gather to discuss issues of mutual concern. The PLC provides a continuing forum for learning and implementing new ideas (Bryk & Schneider, 2002). Borko (2004) describes this networking activity as instrumental in teacher in-service. According to Borko, teachers identified the building of professional networks as a benefit from the participation in programs such as the National Writing Project and Developing Mathematics Ideals. Built into these programs were opportunities to work collaboratively allowing the "...participants to contribute to the solution of convergent problems and difficulties according to their current abilities (Wells, 2000, p. 56)." The presence of this collective effort allows the individual to develop with more support than would be possible if done alone (Wells, 2000). These situated learning opportunities rely on the social networks within an organization and when applied to the school culture, these support mechanisms will prove invaluable for disseminating the constantly evolving information related to technology. Professional learning communities (PLC) built on relational trust (Bryk & Schnieder, 2002) can help smooth the way for continued growth and support for technology integration. Support within a PLC bounded in relational trust diminishes the risk associated with reform or changes concomitant with the integration of technology.

In conjunction with PLCs, aided by the increasing interest of online social networking sites, professional learning networks (PLN) are beginning to grow in popularity. Ning.com hosts a number of content related forums with an international

membership. Teachers are no longer restricted to learning networks constrained by their geographic location. Online it is possible to share and learn from a seemingly infinite number of educators around the world. Sites like Ning.com often created to service a specific content interest also allows for the creation of affinity subgroups. A visit to The English Companion on Ning will reveal a subgroup of over 900 English teachers interested in Teaching with Technology. This new kind for social network can be the solution for teachers in the previous case studies who lamented the lack of resources for understanding how to effectively use technology in their classrooms. Teachers are meeting online at a variety of social networking sites including Twitter, Facebook, LinkedIn, and Second Life. Over time these online meeting places may replace the early teacher oriented web sites, such as those authored by Kathy Shrock or David Warlick's, which offered myriad of resources but little or no interaction with anyone other than perhaps the site's author. The Internet and the variety of Web 2.0 features available make collaboration and communication a mere keystroke away taking the concept of a social network to a new level. The only thing missing for teachers involved in PLCs or PLNs is a knowledgeable person in their physical social network to initially guide them in the direction of a plethora of online resources. The need for a knowledgeable resource brings us to a closer look at this concept of a knowledge broker or technology integration specialist.

### *How Knowledge Brokering Works*[3]

In 1997, the Canadian government and various agencies came together to discuss the notion of bartering information (Oldham and McLean). The group discussed the

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[3] This section is based on an article originally published in The Clearing House in 2008. The citation for the text is: Plair, S. K. (2008). Revamping professional development for technology integration and fluency. *The Clearing House*, 82(2), 70 - 74. This citation can also be found in the Works Cited section.

feasibility of marketing information to other countries, particularly third world countries where certain kinds of expertise might not be readily available. Simply put, the idea was to broker knowledge that other countries needed to successfully govern or develop resources. As members of the initial group, Oldham and McLean listed five dimensions of knowledge and placed knowledge brokers in various roles to support users of these knowledge dimensions. The five dimensions included:

- Creating knowledge;
- Acquiring knowledge;
- Assimilating knowledge;
- Using knowledge and;
- Disseminating knowledge.

While the dimensions reflected how knowledge was used by individuals and institutions, the knowledge brokers were described as either integrators of knowledge or brokers of knowledge. The integrators interpreted knowledge obtained from others for use by their communities. Conversely, brokers of knowledge linked or connected knowledge seekers with knowledge creators. The job of the broker was to function as a go between for those seeking information and those who could supply knowledge in various formats.

The thought of knowledge as a commodity to be bartered or sold at first glance seems a bit odd. However, knowledge is shared, exchanged, valued, sought, and purchased wherever there exists those who need knowledge for a particular reason and those who possess knowledge. Realistically, having an intermediary to meet ones' knowledge or information needs seemed to be an effective way to provide or strengthen skills and knowledge for teachers pursuing fluency in technology.

This idea of knowledge brokering is not exactly new to the educational arena. White (1987) equated teachers to brokers of scholarly knowledge. She considered the teacher as a pivotal person who mediated between the scholarly world and that of a classroom. These scholarly knowledge brokers came with a list of responsibilities such as "agents for controlled change (p.20)," liaisons between public knowledge and students prior knowledge, possessors and appliers of knowledge; those who modeled knowledge; redirectors of knowledge; and integrators of different forms of knowledge.

Later, Wenger (2000) described four different forms of brokering that could be appropriate for our purposes. He explored the idea of the broker as intermediary assisting members in one community to gain knowledge from another. Wenger's knowledge broker could make connections in the limited area of information access; could help move knowledge from place to place; could explore uncharted areas and bring new knowledge back to the community, or could connect key people with knowledge to the community.

Considering knowledge of educational or instructional technology as the commodity to be shared, exchanged, valued, sought, and purchased and the concept of a broker or go-between fits perfectly with what teachers need and want when considering the integration of technology. Our knowledge broker would be available for meeting a variety of needs. Awareness, scaffolding of instruction, matching tools to content, and keeping pace with innovations could more effectively and efficiently be done by a knowledge broker with a combination of pedagogical, content, and technological knowledge.

### Knowledge Broker Roles in Professional Development

*Harbinger of Innovation* - The ideal knowledge brokers moves beyond the information available to teachers by attending conferences, participating in collaborative efforts with other tech savvy teachers, and stays current with the latest literature. They know where to find the innovations looming on the horizon. This continuous learning means more awareness for the teachers they support. More opportunities exist to consider new technology tools for student learning.

*Master of Strategies and Techniques* - Knowledge brokers have the time to prepare and fine tune technology related activities. Time is the one commodity in shortest supply for teachers. It is probably the most significant and most identified barrier (Ertmer, 1999, 2005) to the integration of technology and technology fluency. Teachers are unsure what technology to use, how to effectively manage technology resources, and not eager to invest time in what is essentially unknown. They want technology rich lessons to run smoothly and need to feel high levels of efficacy before introducing such lessons to their students. The role of the knowledge broker as a modeler of TPACK, (Technology, Pedagogy, and Content Knowledge) becomes a critical asset for teachers.

*Teaching Artists* - Knowledge brokers represent Friedman's (2007) "great explainers" who have time to do what most teachers can not. They have time to learn about various technologies and how to effectively infuse them into the content. In short, their ability as teachers to explain is their greatest asset. Marcia Loughry elucidated the concept for him, "Here is what this is going to do for you, here is how it will tie into your existing systems *(think content)*, here is how it will benefit you *(think and your students)*,

..." (289) It is in this area that knowledge brokers are able to move knowledge from place to place. This art of teaching and explaining allows for the conversion of what seems to be bewildering techno babble to terms teachers and students can understand. Knowledge brokers can help with the assimilation of what may seem foreign into something useable and manageable in the classroom.

*Johnny on the Spot* – Teachers have expressed the need for on the spot professional development. They want knowledge brokers available when new technology rich lessons are being introduced to students for the first time. They want to know that a call for help when the unexpected occurs will be answered in a timely manner. They want someone available to share their reflections of the merits or foibles of a technology rich lesson. They do not want to contact distant district support technicians who are generally skilled in technology but not in pedagogy or content.

*Catalyst for Change and Unity* - Knowledge brokers make ideal resources for sharing and dispensing the promises of change. But change includes the need to spread the word and increase places or classrooms where change can and does occur. Ideally the knowledge broker will take the lead for coordinating ways teachers can come together and learn together. As an on site support resource, the knowledge broker will be aware of which technology resources are used by content or grade level teachers. By matching teachers within buildings, within districts, with local organizations, or with online social networking groups, the knowledge brokers can provide valuable opportunities for teachers to continue learning about technology and increasing their fluency. To further support change and continued learning, knowledge brokers are in a position to encourage action research projects which help identify the value of technology rich experiences for

students. Rapid changes in technological innovations make it difficult to assess the worthiness of some technology tools. However, teachers involved in action research projects can offer much to the literature about what works in classrooms.

Changes in the contour of technology related professional development like most reforms will not be a simple task. Policy makers and school administrators need to appreciate the difficulties many veteran teachers experience with integrating technology into comfortable existing pedagogy. This change can also be a costly endeavor which creates avoidance rather than acceptance. What is at stake is the opportunity to meet the needs of students today who must prepare for technology in the workplace and in higher academia.

Allowing teachers to fumble along grabbing technology experiences haphazardly is no longer productive or effective. A concerted effort must be made to make TPACK a reality for veteran teachers lagging behind mired in a digital divide with their increasingly tech savvy students. These students arrive with a greater level of comfort with technology but little practical experiences in how technology can support their learning. Believing that new teachers will enter the system as a solution is risky. Many of today's preservice teachers are the product of technologically illiterate teachers (Plair 2007). Brokering knowledge with a different kind of professional development resource can assure that technology, pedagogy, and content knowledge are intersected and merged to alter the way teachers teach and students learn. The potential for these knowledge brokers to support **all** teachers can only lead to successful learning for all students.

***Final Thoughts***

Effecting change is no easy task. This chapter is not meant to challenge leadership or funding considerations but to address a need that exists and offer solutions were these factors not in contention. Policy decisions originating from any level cannot create changes in teaching practices by mandate. Teachers need quality professional development that a) is extensive in duration, b) engages them in active learning; c) focuses on a specific content area or topic, and d) features collegiality and collaborative participation. When considering the No Child Left Behind requirement for technology proficiency by eighth graders and the goal of the National Education Technology Plan to reduce the technology knowledge gap between students and teachers, change cannot and will not occur instantaneously. Experienced teachers are often the least knowledgeable about technology and must have quality professional development to effectively integrate technology into their teaching practices. They also need the ongoing support that comes from participation in professional learning communities or networks and access to knowledge brokers in the form of technology integration specialists. If the goals of NCLB and the NETP are to be realized, teachers, school leaders, and policy makers must all support the kind of quality professional development required in order for teachers to effectively integrate technology and enhance student learning.

Try as we may, some teachers will still be content to remain among the 'technologically challenged.' In the final chapter, I address some of the issues that interfere with attempts to move from people to policy where technology fluency for experienced teachers is the objective.

# Chapter 6

## In Conclusion: Adding a Finishing Touch or Two

In the previous chapters we have heard from higher education, middle school, and elementary school educators who, after over twenty years of exposure to technology, have managed to avoid making it part of their personal or professional lives. Meanwhile, the world they live is permeated with myriad technological innovations. Their reasons for remaining aloof from educational technology are as distinct as those same eight different teachers. Why and how they have circumvented the integration of technology for most of their teaching careers varies from teacher to teacher. On occasion there seemed to be a consistent thread to explain their choices while, on the other hand, each expressed personal idiosyncrasies that prevented forging ahead.

When I started this project one of the things I wanted to look at was how other technologies had influenced a teacher's practice. Over time, I began to realize that the introduction of computers, especially in education, presented many unanticipated questions. Previous innovations had been fairly simple and easily inculcated into classrooms, primarily as instructional tools. Teachers used overhead projectors with the odd student or two coming to the transparencies for a mark up or two. Students were not expected to be the primary users of this instructional tool. Prior to the introduction of computers the teacher would always be in charge of the learning. Film strips and reel to reel film projectors were all teacher tools. None of the teachers in this study had any difficulty finding ways to use these tools in their classrooms. They were fairly simple to operate and simplistic in their mechanics with few moving or changing parts to be of

much concern. The arrival of the computer and the subsequent other technologies filled with microprocessors changed the dynamics.

The tools were no longer as simple or easy to use. It took more than placing a clear plastic sheet over a lighted box to add a new dimension to your instruction. Or fitting a special library book between the jaws of an opaque projector to provide an entire class a view of what could only be seen by two or three students at a time if used without this special aid. None of the teachers found any of these early innovations to be of any special significance when it came to learning how to use them or finding ways to use them in their classrooms. In fact, once the conversations began, there were relatively few innovations relegated to classrooms and the educational environment. The computer, however, meant learning a collection of parts that had to work in concert plus some nebulous thing called software to make it do what was expected. This was not exactly a teacher only tool. In fact, several of the teachers in the study who had experience in the elementary grades used computers to supplement or reinforce concepts using 'canned' software packages during earlier periods of their careers. Computers were not as uncommon as first perceived, just used in a different way. Teachers did not have to know how things worked, only that things were working as anticipated. This was not your ordinary teacher tool to be controlled solely by the teacher. This new addition could be controlled by students in ways that initially teachers selected and later in ways discovered by students. It meant that teachers did not need to really know much more than how to turn on all the parts and get things started before turning it over to students who were finished with the day's assignment or in the case of Zina, students willing to exchange today's journal writing for a stint at the computer with Reader Rabbit.

How computers were used in the classroom rode on the fringes of how the business community used computers. With the arrival of word processing software, there seemed to be a reason to move beyond drill and practice and include document preparation or creative writing via this newest innovation. Some teachers began seeing the potential as a productivity tool and began the more personal use of computers but still evaded its inclusion into their instruction. In the 1980's computer courses arose reminiscent of driver's training classes. Computers had made their way as a staple of the business community and students needed to learn about them giving birth to the Introduction to Computers classes as the newest elective or encore class. The students were on their way to technology fluency but teachers were left out of the equation as needing to be knowledgeable about this new technology. So it would be that the computer classes joined the woodshop, the art room, PE, and the home economics classes as the encore or elective offerings that would never merge or blend in with the core academics. If we did not see hammers and screwdrivers from the woodshop in the English or Science classes, we should not expect to see computers there either. This situation set the tone for years to come and established a basis for teachers not identified as the Introduction to Computers instructor. No other teacher saw the need to learn about what was to create such a tremendous change in all our lives. This unintended decision is at the heart of why experienced teachers express such frustration and angst over something today's students find ordinary.

The teachers in the previous studies have provided some implicit and explicit reasons why after over twenty (20) years technology use in the classroom is not standard operating procedure. Some of those reasons include:

**The prohibitive cost of technology** – Since the norm is to issue one textbook for each student, one would expect that each student also would need one computer or other technology tool. Burns (2002) found this to be the least beneficial way to integrate technology especially into classrooms where teachers practiced some degree of constructivism. Students in computer labs were prone to interact with the computer at the expense of any attempts at collaborative learning. When teachers had only three or four computers in their classrooms students quickly learned the importance of working together.

Because of the larger expenditures needed to provide even four computers to all classrooms in a district, tax payers, board of education members, and administrators wanted validation that this large investment would actually show a return on their investment in the form of increased student achievement. The critics and the skeptics abound today insisting that technology in the classroom is unproductive and a waste of money and student's time. Technology leaders know better but find the rapid changes in technology make empirical research problematic. This validation must come from teachers who are integrating technology and seeing results in the form of student behavior, interest, engagement and, above all, achievement.

**Lack of direction by leadership** – You may recall that the teachers in the previous cases made little mention of the role of administrators in their decisions to either avoid technology or actively seek ways to become more fluent in technology. During the interviews for Chapter Three, teachers were asked about the philosophy of their principals when it came to technology. None of them were prepared to 'speak' for their principals. For the most part the principals did not get in their way if they chose to use

technology. Peggy acknowledged if no costs were involved her principal was generally agreeable to most suggestions related to innovative methods for engaging students. This lack of clear leadership when it comes to integrating technology has made it possible for large numbers of teachers to decide not to use it personally or professionally. There have been instances where teachers have discussed what they do at home or with their own children using technology, but show no interest in using it in their classrooms.

I would be remiss in not pointing out that many administrators fall within the same parameters as my experienced teachers. Many of them are educators who have been in classrooms for many years before becoming principals. Technology is often just as foreign and mysterious to them as it is to the experienced teachers they supervise. Their lack of vision for technology in the classroom means any leadership efforts to help teachers transition to the integration of technology may be non-existent. You cannot lead what you do not know.

**Adult Learners and Technology** – For years innovative uses of technology have been left for the young to embrace and use willingly. The notion prevailed that learning something new became more difficult as we aged, therefore, the older generation would avoid most things related to technology. Although, Janine's story may lend some credibility to this notion, a recent study by the Pew Research Center (Jones, 2009) reported an increase in the use of the internet by those well over forty. The numbers showing internet use by the baby boomers have only recently begun to increase at levels which indicate age will soon become a non issue when we look at the primary users of the internet. Cohen (2005) reminds us that older learners have the advantage of lots of prior knowledge which makes learning new things different but not impossible.

Gerontologists now understand that learning new things keeps the mind sharp and wards off deterioration of our mental faculties. No longer can experienced teachers use age as a reason to avoid learning to use technology.

**Mature Learning Styles** – The teachers in this study were eager to acknowledge changes in their personal learning styles as they moved into their second half of life (Cohen, 2005). These experienced teachers preferred to have someone show them how technology tools worked or model strategies for instructing using technology. Zina pointed out that the days of reading cover to cover instruction manuals for new products. Now her preference is to have features demonstrated and be able to ask questions and be reassured that she can accurately repeat the process being demonstrated. This difference in learning styles needs to be acknowledged and accommodated when professional development is considered.

Part of the interview for teachers in Chapter Four included a question about personal learning styles. At this stage in their lives the teachers were a bit surprised at describing themselves as visual learners. In the past, Zina felt comfortable reading instruction manuals for new purchases. Today, she prefers to have someone show her how things work. Peggy, who is primarily self taught when it comes to technology, indicated she is a more visual learner and also wished to be shown what to do and then be given the opportunity to try to recreate the process. All of the teachers in study were more comfortable learning in social settings. They wanted to learn in collaboration with their peers, especially, when relationships of trust had been established. They found comfort in knowing others struggled to understand the working of educational technology and that the mutual feelings of insecurity allowed them to commiserate with their peers.

If learning styles change over time, more research may be needed to determine how professional development designs need to change to accommodate teachers in different age groups or stages of their teaching life cycle.

**Teacher autonomy** – When it comes to using technology teachers often are the final decision makers. Although opting out of following guidelines for preparing students for high stakes testing would create an uncomfortable environment with administrators, deciding not to undertake any technology related instructional options would be pretty much ignored by the same administrator. Teacher autonomy is the companion of lack of leadership. This ability to determine our own fate can prove detrimental to students and teachers. For example, in a recent conversation a newly retired high school math teacher lamented her inability to secure an accounting position to supplement her retirement because she could not use the spreadsheet program, Excel. She shared that she had never included technology in her teaching because she did not have time to learn it. As a result she has contributed to, first, sending off to the work place students who lack a 21st century skill to offer employers who need a human resource capable of using an electronic spreadsheet. Secondly, she is unable to finally use her accounting degree because she has not updated her skills or prepared herself to use an important accounting tool that has been in use for many years.

**Lack of intuitiveness** – In Chapter Four Zina probably explained it best when she expressed her frustration about not knowing how many of the technologies do what they do. How is it that I can touch a few keys and eventually produce a paper with all my ideas clearly laid out before me? While the desire to know the workings of technology inhibits many users, the same could be said for our relationship with an automobile. It

used to be I could look under the hood and have some idea of what the working parts were and their purpose. Now the microchip is giving the directions in response to my turning the key in the ignition. I have no idea what is happening under the hood yet I faithfully back out of the garage each day and make my way to my chosen destination. Once teachers are able to view technology in the same fashion, its use may become less intimidating.

**Teacher motivation** – Ideally we would like to believe that all teachers are ready and willing to participate in their own professional growth. However, teachers, unlike their students, have agency over their learning (Davis & Krajcik, 2005), which may explain why many have been able to avoid learning how to use technology in their classrooms. Shulman and Shulman (2004), after many years of working with teachers, recognized that teachers can be characterized at different stages of readiness for learning.

> We can describe teachers who are ready to engage in constructivist (or other forms of highly engaged) teaching, but lack the will, the knowledge, and the skill to do so. We worked with teachers who possess the understanding of the principles, but lack the will to pursue them or the skill to implement them. We can even imagine teachers who have the requisite skills, but lack an understanding of their purpose or rationale, are unwilling to apply them, and are uninspired by a vision of education in which they are central. We can certainly conceive of those who possess all the individual capacities, but lack membership in the kind of teacher community that makes possible the transformation of intention into accomplishment. (p. 260)

If we are to believe the observations of Shulman and Shulman, expecting all teachers to be eager to learn how to infuse technology into their classrooms and practice or any other reform is not realistic. This lack of motivation may require more influence by school leadership if there is a true consensus that a technology rich environment is favorable and necessary for student achievement. The teachers in Chapter Three had intrinsic desires to learn about how to use technology with their content. The desire to

find ways to help their students provided the motivation to improve their own professional growth. Reform or changes are generally more likely to succeed when the learners, like our teachers, become involved on a voluntary basis.

### *Policy and Professional Development*

Administrators and policy makers can reexamine ways to provide teacher with more and better technology related professional development experiences. The complexities of technology with its rapid changes and constant evolution can create a sense of powerlessness. Why go through the motions of learning a set of skills or techniques only to have something new appear in a few months or years? While this lack of permanence creates a sense of futility, our relationship with technology outside of the classroom is just as unpredictable and rapidly changing. That obsolescence may be looming may not be a valid excuse for completely avoiding technology in the classroom since our students see change around them when they leave the classroom. Should not our school be the place to help our youngsters understand these changes and how they impact their lives? The question becomes how can school leaders and decision makers help teachers and students prepare for a technologically changing world?

School administrators and decision makers should be partners with teachers in their quest for understanding how to effectively use educational technology. Professional development is a costly expenditure for school districts and distributing training dollars to cover all teachers often means making easy choices like generic, one-size-fits-all inservice events. Cathy's experience with Creative Movement is an example of finding professional development that crosses a variety of content areas. Obtaining consultants to train all teachers to, for examples, write across the curriculum is more cost

effective than meeting the needs of individual teachers. The goal for these school leaders is to find some middle ground for providing needed inservice and being cognizant of the cost involved in providing quality technology related professional development. Suggestions abound in the literature about ways to achieve this end. Zhao et al. (2006) recommend playrooms with technology so that teachers can practice, explore, and experiment in their work environment with colleagues near by who may offer solutions and alternatives. Restructuring the school day has also been suggested since teachers need time to practice doing so during the work day with colleagues and support help available can be very beneficial.

Decision makers may wish to reconsider the need for computer labs (McCrory, 2006) in secondary schools. If the consensus is that educational technology has a place in all content areas, having computers readily available in classrooms is worth consideration. Teachers in the study were often frustrated by the need to reserve computers in a distant location anticipating when they would need them during the course of the school year. Burns (2002) recommends four or five computers to a classroom where students can access them as part of a group project or assignment. While many districts are exploring 1:1 laptop programs, rethinking computer labs may be more viable until the costs involved become more manageable. Recognizing, also, that technology does not equal computers, helping teachers utilize other kinds of technologies may allow students to continue learning in new and different ways using voice recorders, cameras, hand held devices, and even cell phones.

School leaders would do well to consider some of the professional development characteristics that are under the purview of decision makers. Engaging an entire grade

level, content area, or school in adding instructional technology to their teaching practice means teachers will have places to go for affirmation about ideas that are new and different. Working collectively means teachers will feel less isolated and fearful of being a lone learner with no form of support. Concepts of school capacity (King & Newmann, 2000) focus on collaborative efforts by staffs engaged in school reform or strategies for changes in existing practices. Working collectively also means teachers have input into the kinds of professional development they receive. As professionals they should be treated as such by including them in the planning and implementation of professional development (Little, 1993, Hill, 2004).

McCrory (2006) recommended the creation of technology portfolios to support teachers in their learning to use technology meaningfully. This instrument would provide a way to focus on technology that could effectively be used in a particular content. Because of the vast number of options and resources both on and off the Internet teachers would do well to develop a way to evaluate those technologies that would be beneficial within their content area. Teachers, however, will likely need assistance in identifying strategies for selecting and evaluating potential technologies. For example, Hofer and Harris (2009) have created taxonomies pairing learning activities with technologies for use in social studies content. (See http://activitytypes.wmwikis.net for more content taxonomies.). Their goal is to provide teachers with appropriate technologies to use for particular learning situations recognizing that many novice users of educational technology struggle to find content specific tools that can enhance learning.

Despite all of our best efforts, some teachers will remain entrenched in their tried and true ways of teaching. As Janine avowed, if using technology would not enhance her

way of teaching and her current methods of instruction were proving to be successful, then the personal effort and sacrifices to become fluent in technology offered little or no benefit. Cathy rationalized her decision to discontinue efforts to become technology fluent and returned to using teaching strategies that had long been a staple in her practice. Davis (2003) after working with science teachers says it all in her title – "Change is Hard." The paradox of remaining in the same space or changing your existing practices was evident in the teachers she studied. Some were receptive and eager to change or explore new techniques and methods while others were resistant feeling that to interfere with the status quo was a waste of time and risky. There is a sense of comfort in doing things repeatedly with apparently successful outcomes. If students are learning or at least meeting our requirements, why go through the inconvenience and the insecurity that comes with becoming proficient in something as unfamiliar as technology?

Wilson and Berne (1999) studied professional development events in order to determine what exactly teachers learn from such activities. They concluded that it difficult to pinpoint the 'what' in teacher learning. They noted that inservice teachers have numerous ways to learn about their craft. "Some learning … goes on in the interstices of the workday, in conversations with colleagues, passing glimpses of another teacher's classroom on the way to the photocopying machine, tips swapped in the coffee lounge, not to mention the daily experience of the classroom (p. 174)." Yet in spite of all of these opportunities researchers are still uncertain "of what exactly it is that teachers learn and by what mechanisms that learning takes place (p. 174)." This inability to understand what teachers are learning through traditional professional development

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complicates efforts to equip all teachers with information age skills. This deficiency creates an uncertainty that the right program will be available to fit every teacher.

Nevertheless, technology encompasses a plethora of techniques, uses, formats, and changes that can be intimidating to even the most tech savvy user at times. Perhaps the direction to take should be to find the consistencies in technology. Burns (2005) suggests that teachers be trained to use 'just enough' of an application to create a curriculum based project. This technique avoids the tendency to teach all the bells and whistles when most may not be needed or used. Burns recommends technology related professional development that focuses on instruction, curriculum, and collaboration rather than skill building. Somehow we need to find ways to demystify technology and hope that reluctant teachers will find ways to feel less intimidated and more intrigued by using technology as an instructional tool. For those teachers determined to remain unskilled in educational technology, leaving them in their current comfort zone may be our only choice. Instead, we can focus on teachers ready, willing , and adventurous enough to take on the challenges of bringing excitement and wonder to student learning with technology.

**Appendices**

# Appendix A - Interview Protocols

## *"I Have Never Had an Intimate Relationship with a Machine"*

1.  How long have you been in education?

2.  Describe your responsibilities, over the years, as an educator.

3.  Professional development is an integral part of changing teacher practice. Describe two (2) or three (3) professional development experiences you have had in the last five years.

4.  Why do these particular professional development experiences stand out for you?

5.  You are an experienced teacher who calls yourself technologically illiterate. Can you tell me more about why you say this?

6.  If you could identify one cause of your lack of technology awareness, what would it be?

7.  What opportunities have you had to become more technologically proficient?

    a.  What professional development experiences have you had devoted to the use of technology in the classroom?

    b.  Have you taken advantage of these opportunities? If not, why not? If so, explain what you have done.

    c.  Have any of these experienced changed your teaching practices?

8.  Do you use technology for personal use? If so, can you give me some examples of how you use it?

9.  Describe some ways you use technology in your classroom with students.

10. Describe some ways you use technology to support your planning for teaching.

11. Would you explain what you see as the role of technology in today's classrooms?

*From Whence Cometh My Help: A Case of Professional Development*

**(Interview Protocol)**

1. Could you tell me about your current responsibilities?

2. How long you have worked as a teacher and in what areas?

3. Could you describe for me four (4) or five (5) of the professional development activities you have experienced within the last 5 years?

4. Which of these experiences would you describe as most beneficial to you as a classroom teacher, and why?

5. Which was least beneficial, and why?

6. What (other) kinds of technology related professional development experiences have you had?

   a.    Was that beneficial? Why or why not?

7. What motivated you to take part in the Intel Teach to the Future Program?

8. Do you use technology in your classroom with students?

9. How have these uses changed since your participation in the Intel program?

10. Do you use technology outside of the classroom?

11. How have these uses outside of the classroom changed since your participation in the Intel program?

12. Let me make a distinction between your use of technology to support your own work and your students' use of technology to support their learning. Are there ways in which you use technology in your classroom to support your teaching that are not directly related to student activities?

13. What are some ways you use technology with your students that are specifically designed to enhance student learning?

14. What mechanisms are in place to help you use technology in you classroom?

15. What resources do you use when you have questions or concerns about the use of technology?

16. How easy or hard has it been to implement what you learned in the Intel program?

17. How familiar are you with the National Educational Technology Standards for Students? For Teachers?

18. How familiar are you with the Michigan Educational Technology Standards?

19. How familiar are you with the technology proficiency and testing requirement for 8th graders in No Child Left Behind policy from the federal government?

### A Tale of Three Teachers: *"Running as Fast as I Can"*

### (Interview Protocol)

1.  How long have you been in education?

2.  Describe your responsibilities, over the years, as an educator.

3.  Professional development is an integral part of changing teacher practice. Describe two (2) or three (3) professional development experiences you have had in the last five years.

4.  Why do these particular professional development experiences stand out for you?

5.  Elaborate on any professional development related to technology?

6.  What comes to mind when I use the term - technology fluent?

7.  How does that term apply to you?

8.  How does that term apply to your students?

9.  When did you begin your deliberate efforts to learn more about the use of technology in the classroom?

10. Technology usually implies any kind of innovation. Will you describe some of the technological changes you have witnessed throughout your career as an educator?

11. Which of these technological advancements did you willingly embrace? Which did you avoid? Explain.

12. If you could identify one cause of your lack of technology awareness up to that point, what would it be?

13. Having technology in the classroom is not the same as integrating technology. What does the term – technology integration - mean to you?

14. What opportunities have you previously had to become more technologically proficient?

15. What professional development experiences devoted to the use of technology in the classroom were made available to you?

16. Did you take advantage of these opportunities? If not, why not? If so, explain what you have done.

17. Did any of these prior experiences change your teaching practices?

18. Do you use technology for personal use? If so, can you give me some examples of how you use it?

19. Discuss the steps you have taken to more proactively learn to use technology professionally?

20. What kinds of resources have you found beneficial in your efforts to become more fluent in technology?

21. What are some of the barriers you that find have hampered either the learning of instructional technology or the use of instructional technology?

22. Describe some ways you use technology in your classroom with students.

23. Describe some ways you would like to use technology in your classroom with students.

24. Describe some ways you use technology to support your planning for teaching.

25. Describe some ways you envision using technology to support your planning for teaching.

26. How compatible is your content area with the technology tools you understand how to use?

27. What additional technology tools might you use in your content area that are not currently used?

28. Would you explain what you see as the role of technology in today's classrooms?

29. How do you see yourself in relationship to the role of technology you have described?

30. How would you describe your principal's philosophy regarding instructional technology?

31. What about the other principals that have been in your building. Where would you say those people were?

32. How does your principal support the use of technology?

33. Who determines what technology is used in classrooms or content areas in your building or in the district?

34. What role do you play in what technology is available to you or to your students?

# Appendix B - Methods Section

The purpose of this section is to provide some insight into the data used for this dissertation especially since the portraiture method, which is more narrative in form, was used for reporting most of the study results. Although one might argue that the narrative is the data, readers may wish to know why and how certain interview data were selected for inclusion in the various 'portraits'. This section is designed to clarify how data was collected and analyzed and includes coding decisions and my thinking process for how to best represent the data collected.

Initially my intent was to relate the stories of teachers, much like life histories "using the person as a vehicle to understand basic aspects of human behavior or existing institutions rather than history (Borgan and Biklen, 2003)." The research subjects would be experienced teachers with more than 15 years in the classroom who were to involved in learning how to use technology in their teaching. Technology for my purposes meant anything associated with computers and other digital devices such as graphic calculators, digital cameras, PDAs, and other micro chip based products. Data would come from whatever teachers were willing to share with me. Any initial thoughts regarding the structure for the data were not clear. As a researcher, I felt my role would not allow me to relate or interpret anything not specifically provided by the teachers. Therefore, anything and everything from the teachers was data which I would then use to construct meaningful narratives.

## *A Word about Portraiture*

Portraiture is a method of inquiry similar to case study, narrative, phenomenological, and ethnographic techniques. As a research method portraiture

underscores the ongoing tension between process (collecting and interpreting data) and product (the portrait). Lawrence-Lightfoot explains that there are "dual motivations guiding portraiture: to inform and inspire, to document and transform, to speak to the head and the heart (p. 243)". The challenge to creating the portraiture narrative requires a combined "vigilance to empirical description and aesthetic expression" (Lawrence-Lightfoot & Davis, 1997, p. 12).

Portraiture is comprised of five features: context, voice, relationship, emergent themes, and aesthetic whole. Lawrence-Lightfoot and Davis explain the purpose of researchers using this method as follows.

> Portraitists seek to record and interpret the perspectives and experiences of the people they are studying, documenting their voices and their visions - their authority, knowledge and wisdom. The drawing of the portrait is placed in social and cultural context and shaped through dialogue between the portraitist and the subject, each one negotiating the discourse and shaping the evolving image. (Lawrence-Lightfoot & Davis, 1997, p. xv)

This method seemed appropriate for my purposes in understanding the predicament experienced teachers faced trying to learn and become knowledgeable about something that was basically foreign to them. Using this method supported my belief "that human experience has meaning in a particular social, cultural, and historic context" (p. 43) and as a research method "it allows the actors to express themselves more fully, more naturally (p 43)." Since voice is an important facet of this method, my voice as researcher becomes a part of the portrait. Actually, Lawrence-Lightfoot & Davis (1997) stress the importance of the portraitist "sketching" herself into the portrait. Davis points out, "this assertion of researcher perspective invites the reader to join actively in the journey of discovery of understanding (p. 66).". Ideally, readers would appreciate the plight of both the teachers as learners, and me, as the facilitator for their learning. There

was essentially no way to remove myself completely from the portraits I was painting, although I made a effort to remain in the background as much as possible.

## *Data Collection*

Because the teachers' stories were the primary goal, an ethnographic viewpoint created the context for this dissertation. No classroom observations were made. No student or teacher artifacts were collected. No survey tools were included. The intent was to get inside the head's of the teacher subjects. Self reporting grounded all of the case studies fully understanding that memories and reflections of past events could be inaccurate. However, since I was not trying to prove or verify any accounts, what they told me was what they perceived as a reality at the time of each interview. Therefore, the narratives I created were interpretations of what teachers were willing to share as their personal accountings of how technology fit into their roles as teachers.

The first interviews with Janine and the group of six teachers were recorded using a cassette tape recorder. Eventually, I was able to purchase a high quality voice recorder and used both to capture each interview. All data, except for that from the interview with Janine, was converted to a digital format and became individual files on my desktop computer. The interview with Janine was transcribed directly from the tape. All other data was transcribed from the digital files into Word files using an audio editor, Audacity, which is used to create podcasts for adding audio to web based content. Digital files had to be converted from Windows Media Player (WMP) format to MP3 format so that Audacity could read the files. I located a free file format converter to accommodate file requirements Audacity. Using this tool allowed for more playback options since I often listened to tapes in my car on an MP3 player.

By using the Audacity editing features I could mark sections of the recording, easily identify a position within a recording, and slow the speed of the replay making the process of transcribing easier. Audacity features also allowed for an automatic repeat of a passage when the quality of an exchange made portions of the interview difficult to understand.

I should note that as a novice researcher I missed more than one opportunity to probe for more information since I felt obligated to adhere to the interview protocol rather than use it as intended – to give some structure to the interview. I was unprepared in those early interviews to allow for digressions when teachers alluded to something slightly off topic. All interviews were conducted in teachers' classrooms for two reasons. First, I was able to photograph the layout of a classroom and identify the location of the classroom computer. These photographs, however, were not included as a part of the case studies. Second, I wanted to accommodate their schedules and not impose on their non-contract time any more than necessary. Most of the interviews were conducted at the end of the school day so teachers could head for home rather than another destination to meet with me.

### Interview Protocols and Coding

The interview protocols (see Appendix A) were used to begin selecting codes which were somewhat a priori in nature. Though no specific codes were identified before interviews were initiated, the protocols established a foundation for determining the language to use for coding. For example, each interview began with a question about the teacher's background. This basic code - background – would provide a picture of experience, grade level, and teaching assignments. Generally, by the time I began the

process of analyzing data, I was very familiar with the content. The codes that emerged beyond those driven by the protocols represented the data I felt would create the most meaningful account of a teacher's experiences. The codes, were perhaps, more intuitive based upon what I 'heard' from the data.

The codes for Chapters Two and Three are fairly uniform. Only one subject is used in the first chapter so the data and the codes are relatively small and simple (See Table 1). In the third chapter, the codes are uniform across all six teachers (See Table 2). With Chapter Four the data and the codes are nearly as different as the teachers (See Table 3). For example, Cathy and Zina spoke a great deal about fear while Peggy, who has long been a user of technology, never made any reference to fear. Even the narrative was more difficult to create since there is such a difference in how these teachers came to use technology and in the attitudes they developed toward becoming more fluent in technology. Emergent codes came from these differences and the interview protocol was used again to establish a base for interpreting their stories. The emergent codes are not differentiated from the a priori codes because I did not distinguish when a category was added beyond the initial a priori codes. Too much time has passed to recall when something was added and I can only assume that code categories at the end of any list were probably added at some later time.

### Working with the Data

An important question to answer was the kinds of professional development experiences the teachers had experienced. However, Janine spent far more time at the delivery end of professional development making such a question for her almost pointless. The interview, while covering questions I felt important to ask, was very short

and therefore provided a relatively small amount of data (See Table 1). This situation meant I had to rethink the direction to take for using the data and developed a set of themes to use for structuring the narrative. See Table 1 for the themes and codes used for Janine's story. Once the themes were established I returned to the transcripts to find support for each thematic category.

The interviews for Chapters Three and Four were different in both quantity and length. To organize the data I created a chart for each transcript. The chart served dual purposes: a) as a way to locate specific content and b) as a 'view' of the data in a form resembling a bar or column graph. The a priori codes were entered as column headings before returning to the transcripts for supporting evidence. These a priori codes were extracted from the interview protocols or from points that stood out while reviewing the audio recordings. Emergent or inductive codes were added to the chart when something a teacher said was judged as needing further attention or when I realized some word or phrase had occurred in another interview and might have some significance for the entire group.

Under each code I noted the paragraph number of a particular phenomenon from the hard copy created in Word. Occasionally short annotations were included. When the charting of references was completed, the bar or column graph would become more apparent. Codes with numerous references meant teachers had much to say about a particular code. For example, the column for the code 'fear' was generally a long one suggesting the presence of a story to be told about the role of a teacher's fear related to the use of technology in the classroom.

**"I Have Never Had an Intimate Relationship with a Machine"**

**Part One – Research Questions**

- How does one teacher describe her relationship with instructional technology?
- What aspects of her background add to or detract from her proficient integration of technology?
- What role might professional development play in supporting someone like her in the area of technology integration?

**Part Two – Analytical Themes**

1. The subject's knowledge of technology in general;
2. The subject's use of technology both for personal and professional use;
3. The subject's involvement in professional development activities in general;
4. The subject's teaching experiences and practices including but not limited to any related to technology.

**Part Three – Analysis Codes**

| Code | Description |
| --- | --- |
| Background | Teaching experience, grade level, |
| Professional development | Kinds of PD, general and technology related |
| Technology use | Personal and professional uses of technology |
| Technology use with students | How technology is used with students/as teacher |
| Fear | Repeated phrase by interviewee |
| Issues of control | Repeated phrase by interviewee |
| Barriers | What prevented use, access, or knowledge |
| Issues of support | Who helps if problems occur? |
| Must Use | Certain phrase or comment I want to be sure to use. |

**Table 1 - Chapter 2 Research Questions, Themes, and Codes**

**From Whence Cometh My Help: A Case of Professional Development**

**Part One - Research Questions**

- What were typical general and technology related professional development experiences of veteran teachers?
- How did experienced teachers use technology in their personal and professional lives before and after an extend technology related professional development event?
- What kinds of support systems were identified by experienced teachers as necessary for sustainability and enhancement of their technology skills?

**Part Two – Analytical Themes**

1. The subject's experiences with professional development both technology related and professional development in general;
2. The subject's use of technology for professional and personal use both before and after the inservice;
3. The subject's perceptions about the support systems that were in place and how these systems might aid in sustaining their technology skills.

**Part Three – Analysis Codes**

| Codes | Description |
| --- | --- |
| Background | Teacher experience, grade level |
| Professional Development | Opportunities for PD – general and technology |
| Personal Use | What technology is for personal use? |
| Students and Technology | Technology used with or by students in classroom |
| Integration of Technology | Deliberate integration of technology |
| Teacher Knowledge | How do teachers know about technology |
| Efficacy/Confidence | Any mention of confidence or lack of confidence |
| Barriers | What prevents the use of technology anywhere |
| Reference to Knowledge Broker | Any mention of someone who helps with technology |
| Change in Practice | Instances of change due to technology |
| Support Issues | Any mention of assistance or lack of assistance |
| Gate keeping | Who gets in the way or controls use of technology |
| Must Use | Phrase or comment I want to be sure to use. |

**Table 2 - Chapter 3 Research Questions, Themes, and Codes**

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## A Tale of Three Teachers: "Running as Fast as I Can"

### Part One - Research Questions and Themes

- How do teachers reflect and react to the educational technologies encountered during the course of their teaching careers?
- How do we describe the attitude of these teachers toward instructional technology in contrast to the initial interviews from Chapter Three?
- What can we learn about how teachers cope with the complexities of trying to include educational technology in their practice?

### Part Two – Analysis Codes

| Codes | Descriptions |
|---|---|
| Background | Teacher experience, grade level |
| Professional Development | Opportunities for PD – general and technology |
| Attitude toward technology | Beliefs, effectiveness, desire to use |
| Integration | Examples of technology integration |
| Fear | Repeated phrase |
| Innovation | Technological changes in educational tools |
| Technology Use | Personal or professional use of technology |
| Fluency | Descriptions of fluency in technology |
| Change in Practice | Instances of change in teaching with technology |
| Knowledge Broker | Who provides assistance or knowledge |
| Issues of support | Examples of how problems are solved |
| Lack of interest | Unique to Cathy – comments indicating no interest |
| View of students | Role of students in decisions to use technology |
| No help | Repeated phrase |
| Administrator Views | References to principal's philosophy about technology |

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**Table 3 - Chapter 4 Research Questions, Themes, and Codes**

Short bars or columns were either ignored or examined to expose phenomena that might be missing in the data. For example, gate keeping, though an emergent code, had fewer references than anticipated when the code was initially added to the chart. However, while some teachers mentioned examples of gate keeping the total number of direct references overall was very small. This led me to question whether teachers

realized when instances of gate keeping blocked their efforts to use technology. These incidents of omission, like emergent codes, led me back into the data from other interviews to determine if there were references I had overlooked or ignored as not being meaningful in a particular iteration of the data.

To develop the themes I used the columns with the largest number of references to the interview data and then outlined the general concept of each theme that I thought could be used to create a plausible narrative. I used this thematic approach as a way to develop or organize the subheadings for the various chapters. See Tables 1 – 3 for the themes constructed for Chapters 2 – 4. Throughout the writing of the narrative, I tried to be true to the voices of the teachers. At times this was difficult because we were all employed by the same district. I made every effort to use only the information I obtained from the teachers through the interviews. This was challenging in some instances because I knew things that went beyond the surface of the interview and that were issues teachers did not want to be associated with in providing certain information. I tried to be ethical and honor their wishes to be evasive or vague about certain topics.

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