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Julie Angers
Education Consultant, jangers@cox.net

Krisanna L. Machtmes
Lousiana State University, kmachtmes@agctr.lsu.edu

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Abstract

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Keywords

Technology Integration, Ethnographic-Case Study, Exemplary Teachers, Beliefs, Context Factors, and Practices

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Julie Angers
Education Consultant, Baton Rouge, Louisiana

Krisanna Machtmes
Louisiana State University, Baton Rouge, Louisiana

This ethnographic-case study explored the beliefs, context factors, and practices of three middle school exemplary teachers that led to a technology-enriched curriculum. Findings suggest that these middle school teachers believe technology is a tool that adds value to lessons and to students' learning and motivation. Due to a personal interest in technology, these teachers are self-taught and apply for grants to acquire new hardware and software. They receive support for release time to continue with ongoing professional development, which has helped to change their teaching strategies from teacher-centered to student-centered. They are not afraid to take risk using trial and error, flexible planning, project-based lessons, varying roles, varying grouping, and providing multiple activities in their classroom practices. Key Words: Technology Integration, Ethnographic-Case Study, Exemplary Teachers, Beliefs, Context Factors, and Practices

Introduction

Teachers cannot escape the fact that today's classrooms must provide technology-supported learning. The International Society for Technology Education (ISTE) report (2000b) states that today's classroom teachers must be prepared to empower students with the advantages technology can bring. Teachers have to work toward encouraging students to become critical thinkers, collaborative colleagues, and technology-literate citizens (Sage, 2000).

Being prepared to use technology and knowing how that technology can support student learning must become integral skills in every teacher's professional repertoire. ISTE (2000b) endorses technology integration that is student-centered and emphasizes teacher facilitation. The use of technology for curricula and professional activities requires substantial investments of time, money, equipment, and most of all a personal commitment and courage to try new things (ISTE, 2000b). District and school policy and professional development workshops are designed to positively influence teachers' adoption of technology: However, the adoption and use in the classroom is determined by teachers' attitudes and beliefs about technology (Ertmer, Addison, Lane, Ross, & Woods, 1999). Studying beliefs and context factors of teachers using computers helps to

understand how to achieve technology integration. Considering the degree of the teacher's influence, it is important to gain a better understanding of the specific practices under which technology innovation can take place in classrooms.

As the availability of technology in schools and classrooms has grown, so has interest in the extent to which these technologies are being used and for what purposes (Honey, Culp, & Carrigg, 1999). Very little qualitative research has been done at the middle school level, and this study helped to expand the knowledge of technology integration for the middle school teacher. Missing from the research is evaluation data obtained from prolonged observations in a classroom setting where technology was integrated into the curriculum. It is important to observe the actual extent to which computers are integrated into the classroom environment (Painter, 2001) because of the criticisms of self-reporting assessments, which tend to be upwardly biased). A qualitative approach to determine patterns of behavior and cultural themes in the use of technology in the classroom, by exemplary technology teachers, can provide scenarios of classroom practice that other teachers may emulate.

For this study an exemplary technology teacher was defined as a teacher demonstrating skills, knowledge, and understanding of current available technology and translating that knowledge by designing developmentally appropriate learning opportunities for students (ISTE, 2000b). The study was guided by a central question: Are there certain beliefs, context factors, and practices of an exemplary technology teacher that will provide an in-depth understanding of exemplary teaching practices that leads to a technology-enriched curriculum?

Information gathering at the exploratory stage of this study helped to develop an understanding of how and why three middle school teachers evolved in their use of technology. Using both direct and participant observation, the Spradley model (1980) was followed with three rounds of observations: (1) descriptive, (2) focused, and (3) selective. Interviews were conducted with open-ended questions and documents were collected from the school system website.

Literature Review

Technology Integration

The goal of transforming teaching and learning by increasing access to, and use of, technology in schools and classrooms has been near the top of most educational reform agendas since the early 1980s (Cuban, 2001). Public schools have made consistent progress in expanding Internet access in instructional rooms. In 2003, 93 percent of public school instructional rooms had Internet access, and the ratio of students to instructional computers with Internet access was 4.4 to 1 (Parsad & Jones, 2005).

Over $7 billion is invested annually in educational technology, making computers, the Internet, and software increasingly available to more and more students (Staples, Pugach, & Himes, 2005). In 2003, 10 percent of public schools provided hand-held computers to students and teachers for instructional purposes. Nationwide, 88 percent of public schools with access to the Internet had a website. Eight percent of public schools put laptop computers in the hands of the students (Parsad & Jones, 2005).

In 2000 only half the teachers with computers available in their schools used them for classroom instruction (Smerdon & Cronen, 2000). In 2003 Norris, Sullivan, Poirot, and Soloway reported that teachers' use of technology for curriculum purposes was almost exclusively a function of their access to that technology. Technology acquisition creates a different context and opportunity for learning. Technology must permeate all aspects of a school's ecological system, including students, teachers, classrooms, and administrative leaders (Staples et al., 2005).

Integration requires that teachers readily and flexibly incorporate technologies into their everyday teaching practice in relation to the subject matter they teach (Hadley & Sheingold, 1993). Integrate means to make whole or to renew (Kinnaman, 1994). Integration is incorporating technology in a manner that enhances student learning. Technology integration is having the curriculum drive technology usage, not having technology drive the curriculum (Dockstader, 1999). Dockstader further stated that technology integration is using computers effectively and efficiently in the general content areas, to allow students to learn how to apply computer skills in meaningful ways.

"Technology façade is best described as the use of technology in a school without the benefit of a necessary infrastructure to support its application as a viable instructional strategy" (Tomei, 1999, p. 32). Technology integration requires the highest level of expert teaching skill because it requires teacher selection of strategies. A teacher must draw on a repertoire of curriculum knowledge, knowledge of student abilities and needs, and knowledge of technology resources in deciding how to integrate technology into any given lesson (Painter, 2001).

Integration is making pedagogical and curriculum changes to include technology (Wetzel, 2002). Proficient computer-using teachers establish a socially interactive and reflective community of practice with their classrooms. They have a strong commitment to learner-centered approaches in which students take responsibility for self-regulation of their learning and behavior (Ryba & Brown, 2000). The teachers are creating structure, providing advice, and monitoring progress as the "guide from the side" (Kozma, 2003; Tiene & Luft, 2001).

Technology has altered how educators run their classrooms, with 88% of teachers reporting that computers have changed how they teach (Rother, 2003). The role of the teacher is being transformed from one of primary dispenser of knowledge to one of being a facilitator of learning. The teacher provides information in the context of a rich learning environment, in which the student is an active learner. The teacher's role is to plan for and manage the computer-learning environment, and to facilitate and guide the learning that goes on within it. Ryba and Anderson (1993) defined the five main components of the teacher's role as (1) planner, (2) manager, (3) facilitator, (4) guide, and (5) participant.

Berg, Benz, Lasley, and Raisch (1998) completed a descriptive study that identified and described how exemplary technology using teachers are using technology in their elementary classroom. In this study, the researchers identified an area they grouped as "instructional design;" an area in which coordinators stressed such things as the importance of collaboration, integration of subject areas, individualized and interactive learning, and communication with parents. Exemplary teachers verified this importance, citing motivated students and keeping students interested and experiencing

success and changing from traditional classrooms to using a wider variety of teaching techniques as the two most important uses of technology. The teachers in this study invested a great deal of time with professional development and most frequently learn technology skills on their own.

Findings from a nationwide survey of teachers experienced at integrating computers into their teaching revealed a compelling story of motivated and professional teachers who learned to use computers in their classrooms in multiple ways. The results revealed teachers who had gone beyond just knowing how to use computers to knowing how to add computers into their current practice and transformed their practice. Making their classrooms less teacher centered and more student centered, getting students actively involved doing projects and creating products, helping students to do more thinking and interpreting, giving students more individual attention, and allowing students to work more independently, they teached differently and more effectively than they did in the past (Hadley & Sheingold, 1993).

Research within many classrooms, shows the use of technological tools and resources supporting students as they search for information, design products, and publish results. Students are more engaged in independent, individual investigations or collaborative small group assignments (Kozma, 2003; Tiene & Luft, 2001). However, interviews with 500 seventh through twelfth graders demonstrated a wide gulf between technology's promise and the reality of use in schools. Although the average use of school computers is a little under three hours a week, 50% of students with computer access at school use school computers one hour or less a week. Only 24% of students said they use computers most often in their classrooms, while 74% reported using them most often in computer labs, libraries, or media centers (Doherty & Orlofsky, 2001).

Students must use technology tools. Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and to present it professionally (The International Society for Technology Education (ISTE), 2000a). A technology-rich environment offers students the opportunity to become active participants in the learning process.

Teachers' Beliefs

How teachers view their role as teachers influences how they teach with technology. Teachers' beliefs about classroom practice appear to shape their goals for technology use as well as the weight they assign to different barriers. Both external and internal barriers often hamper successful technology implementation. External barriers include limited equipment, training, and time. Internal barriers confront beliefs about current practice and lead to new goals, structure, and roles. These barriers are intrinsic to teachers and include beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change (Ertmer et al., 1999). Changing teaching requires more than just time to investigate new methods. It also involves a personal commitment and courage to try new things. Leaving the comfort zone is very uncomfortable, if not somewhat scary (Titterington, 2000).

Research by Vannatta and Fordham (2004) indicate the factor combination of the amount of technology training, time spent beyond contractual work week, and openness

to change work together to predict overall classroom technology use among K-12 teachers. They determined that a willingness by teachers to commit time above and beyond the call of duty and a risk-taking attitude are important in developing technology-using educators. Learning to use technology as an instructional tool requires willingness to make mistakes and to learn from them.

Teachers' resistance to change is primarily due to concerns regarding the influence of instructional technology integration on their preparation, beliefs, and values. Long-term change takes place when teachers take ownership in a new instructional strategy or technological tool. To successfully implement the integration of a new technological tool, consideration of what the implementation will mean to teachers' personal beliefs and values is of great concern. Teachers who want to change are proactive, want to grow, and are reflective. They continually try to do what is best for their students (Wetzel, 2002).

Context Factors

Technology has the potential to expand information sources, provide individualization, and help students and teachers make interdisciplinary connections (Boethel & Dimock, 1999). Although technology is moving into the classroom, faculties have been reluctant to adopt computers and revise their pedagogy. Researchers are emphasizing questions that try to gain an understanding of how technology use is mediated by factors (Becker & Riel, 2000; Boethel & Dimock; Byrom, 1998; Honey et al., 1999; Jaber & Moore, 1999; Lumpe & Chambers, 2001; Mouza, 2002; Ronnkvist, Dexter, & Anderson, 2000; Vannatta & Fordham, 2004). Common barriers to the use of technology by teachers include: vision, access, time, assessment, and professional development (Franklin, Turner, Kariuki, & Duran, 2001). The challenge is how to prepare the main body of faculty to expand their use of instructional tools, to incorporate computers and new technology (Rups, 1999).

Some reform strategies key to integration includes such factors as the organization of the classroom, the pedagogical methods of the teacher, and the socio-cultural setting of the school (Honey et al., 1999). Lumpe and Chambers (2001) identified 14 categories of contextual factors impacting teachers' beliefs about technology. These categories included the following: resources, professional development, Internet access, quality software, classroom structures, administrative support, parental support, teacher support, technical support, planning time, time for students to use technology, class size, mobile equipment, and proper connections. For the most part, the teachers displayed fairly positive beliefs about the 14 factors. However, the teachers generally did not believe that many of the enabling factors will actually occur in their school.

Most teachers claim that they learn by personal experience at home (69%) or by trial and error (58%). Even so, they report deficiencies in ongoing technology training (Yildirim, 2000). A majority of teachers reporting had fewer than five hours of training, while 33% had no computer training in the past year (Rother, 2003). Training makes a positive difference to those who receive it. Teachers who received 11 or more hours of curriculum-integration training are five times more likely to say they believe they are much better prepared to integrate technology into their classroom lessons than teachers who received no such training. Teachers who received both basic-skills and integration

training tend to believe they are better prepared than those who received just one type. Teachers receiving more training of either type, but especially of integration training, are more likely to use software to enhance instruction in their classrooms (Doherty & Orlofsky, 2001).

Research literature says that leadership is the single most important factor affecting the successful integration of technology (Byrom, 1998). Support for technology is necessary at the state, district, and school levels. Research findings indicate that administrative leadership and decision-making are equal, if not more important than spending on infrastructure to maintaining a successful technology program (Anderson & Dexter, 2000). Administrators should discuss with staff how technology can best be used to enhance teaching and learning. They must be prepared for a significant investment of time to move technology from a part-time tool to an active tool fully integrated into the curriculum (Slowinski, 2000).

Method

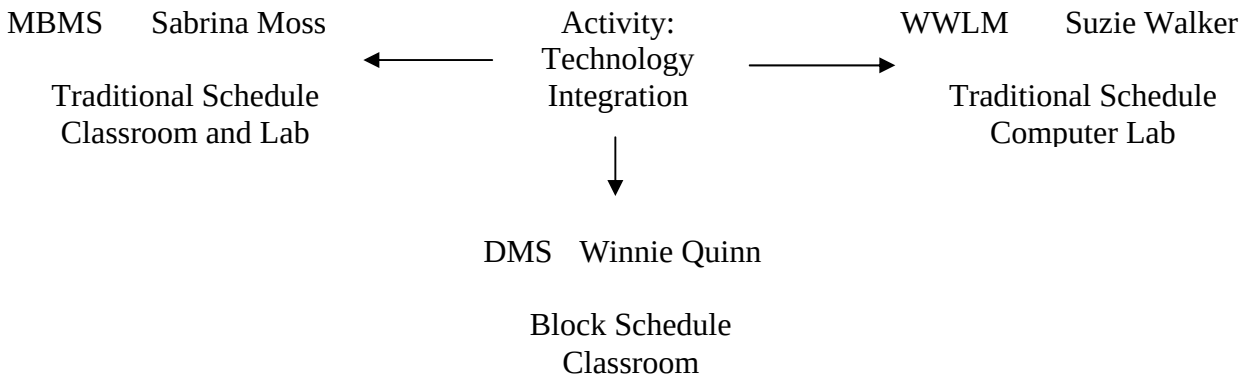
Participants and Setting

The school district was chosen for their reputation of high technology use. The administration was contacted and was supportive of the study, and provided access to the teachers. The researchers and teachers had not met prior to the study. The teachers for this study were selected from a list of teachers participating in the Implementing Technology Enriched Curriculum (I-TEC) grant. After studying the teacher list a decision was made to focus on the science curriculum at the middle school level. Barron, Kemker, Harmes, and Kalaydjian (2003) compared integration of computers in the classroom by subject area: It appeared that science teachers were using technology more frequently. Purposeful sampling (Patton, 1990) provided maximum insight and understanding of technology integration in middle school classrooms. It allowed sufficient time to undertake a full and richly detailed study.

The teachers chosen for observation and interview were Winnie Quinn, sixth-grade Science, from DMS Middle School; Sabrina Moss, seventh-grade Science from MBM Middle School; and Suzie Walker, sixth, seventh, and eighth-grade Applied Technology from WWLM Middle School. The names used for the teachers and schools are pseudonyms.

Choosing these teachers allowed the study of the same phenomenon, “integration” in three different venues (see Figure 1). Winnie’s school used 90-minute block scheduling, and she had access to computers only in her classroom. Sabrina’s school used traditional 55-minute schedules, and she had access to computers in her classroom and in a computer lab. Suzie’s school used the traditional 55-minute schedules, and she had her own computer lab for teaching.

Figure 1. Representation of different venues.



Individual rights to privacy and confidentially were extremely important in this study. Before beginning observations and interviews informed consent was discussed and signed by participants. In addition an IRB exemption 2415 was filed and approved by the University.

Procedures

Since this study focused on exemplary technology teachers' beliefs, context factors, and practices the ethnographic case study was best suited for the research. Creswell (1998) defines ethnography as a description and interpretation of a cultural or social group or system. He further states ethnography involves prolonged observation of the group, in which the researcher is immersed in the day-to-day lives of the people, and/or one-on-one interviews with members of the group. The goal is to comprehend the particular group or culture through observer immersion into the culture or group (Silverman, 2000).

The case study is an exploration of a bounded system or a case (or multiple cases) over time through in-depth data collection. The case study researcher uses multiple forms of data rich in context to build the in-depth case (Creswell, 1998). A case study method is used when the researcher deliberately wants to cover contextual conditions that might be highly pertinent to the phenomenon of study (Yin, 2003). This project was designed as a case study to better understand how three teachers, as individuals and as a group, adopted and integrated technology into their classroom practice.

An ethnographic case study is defined as prolonged observations over time in a natural setting within a bounded system. The observational method is the chosen method to understand another culture whereas, the case study is used to contribute to our knowledge of individual, group, organizational, social, political, and related phenomena (Yin, 2003). Using the ethnographic case study method allowed for exploration of actions and events of three exemplary technology teachers over a prolonged period of time in their natural setting; providing a deeper understanding of technology integration in the middle school classroom curriculum.

The ethnographic characteristics of this study are the description and interpretation of the culture-sharing group. The context in which human experience takes

place must be naturally occurring, not contrived or artificial (Ary, Jacobs, & Razavieh, 1996). With prolonged observations in natural settings, the focus was on behavior, language, and interactions of the three exemplary teachers. To gain a better understanding of teacher practices in a technology rich classroom, a total of 25 days was spent in the natural setting collecting data for analysis. The observations took place in each teacher's class or computer lab. How each teacher functioned in her natural environment integrating technology into her lessons was recorded. One objective was to identify teachers and students use of computers. The multiple-case study characteristic of this research is the real-life context of the three teachers integrating technology into their classroom curriculum.

With extended immersion in the field, typical of qualitative research, there was a concern about the validity and reliability of the researcher's own interpretation of their set of participants (Silverman, 2000). It is important to identify some ways of dealing with results because issues of validity and reliability are an important part of any study. Conducting member checks by initiating and maintaining an active corroboration on the interpretation of data between the researcher and the participants helps in controlling validity and reliability. Each participant in this study was afforded opportunities to read, correct, and make comments on written descriptions, assertions, and interconnected components. At any time, participants were allowed to read field notes and observations if they were curious about what was being written. Triangulation methods of observation, interview, and document analysis were used in this study to validate and corroborate data obtained during the study. With triangulation the researcher can guard against the accusation that a study's findings are simply an artifact of a single method, a single source, or a single investigator's bias (Patton, 1990). All transcribed interviews, notes, and observations were read by the author (K.M.) to corroborate assertions.

To check for credibility of the data being gathered and to confirm developing themes, techniques of prolonged engagement and repeated observation were used. Technical rigor in analysis is a major factor in the credibility of qualitative findings (Patton, 1990). The constant comparative method of inspecting and comparing all the data of a single case was used in data analysis to address the concern of credibility. This was followed by the constant comparative method across cases.

In qualitative studies, the researcher is the instrument (Marshall & Rossman, 1999). Observation usually means the researcher acts to find out what people do. Direct observation involves merely watching what is happening, but not participating in the activity being observed, and recording events on the spot. Observational evidence is useful in providing information about the topic being studied (Yin, 2003). One distinct advantage of the observation technique is that it records actual behaviors as influenced by the observer's bias, not what people say they did or believe they will do.

Both direct observation and participant observation were employed at various times, depending on the activity. When the teacher was involved with direct instruction, the author (J.A.) observed from a place in the classroom that afforded a clear view. When students were working independently or in small groups she circulated around the room, talking to students, observing what they were doing, answering some questions, and assisting with software commands. All three teachers encouraged participation and welcomed help. During the first round of observations the teachers encouraged J.A. to walk around and observe what the students were working on. Students were not the

primary unit of study, but their technology skills and ability to complete computer projects were important to analysis of teacher practices. The observer was never introduced to the students, and strove to maintain a presence in each classroom that was as natural as possible. She did not want to be involved in any way that would alter the established routines of the classroom. All observations were recorded with paper and pencil, and then transcribed into Microsoft Word software.

Observations were followed by a one-on-one interview with each teacher. The purpose of the interview was to gain information about the teachers' views and experiences with technology. J.A. was the interviewer: providing clear explanations of the questions, helping teachers feel at ease, and operating the audiotape for data collection.

The eight questions asked each teacher in the one-on-one interview included:

1. How were you chosen to participate in this grant?
2. What were your skills or expertise with regard to technology prior to participating in this grant?
3. How did you acquire your skills?
4. How were you incorporating technology prior to participating in this grant?
5. What are your personal beliefs about the role of technology in the curriculum?
6. How does the use of computers relate to these beliefs?
7. Are there any specific practices in your school or district that have been instrumental in helping you integrate technology into your classroom?
8. How did you manage your preparation time for integrating technology?

Data Analysis

Data collection began with a grand tour descriptive observation (Spradley, 1980) with each teacher. In the first round of observations J.A. collected and recorded many pages of field notes describing classroom space, objects in the classroom, actions and interactions of the teachers and students, teachers' and students' activities and goals, and time periods. Daily analysis consisted of entering field notes into Microsoft Word software, reading and rereading notes, completing domain analysis, and constant comparison searching for patterns and themes.

An observation instrument was utilized for the focused second round of observations. The instrument, Integration of Technology Observation Instrument, was developed by investigators and staff from Arizona State University and Mike Timms of WestEd as an evaluation component of the Arizona State University Preparing Tomorrow's Teachers to use Technology (PT^3) grant (http://www.west.asu.edu/pt3). The technology observation instrument is structured with checklists and rating scales that easily translated into a Microsoft Excel spreadsheet for analysis. Each class period was observed with a new observation sheet. Activities in the classroom were recorded at five-minute intervals, with a combination of check boxes and written notes describing activities and interactions of the teachers and students. A spreadsheet was developed for each teacher transferring the variables from the observation tool onto the sheet. Upon completing the second round observation with each teacher time-linked data was analyzed for the percentage of time each variable was observed in the classroom and

posted to the spreadsheet. The written notes were transcribed into Microsoft Word, read and reread, added to or compared to the domain analysis, and constantly compared to check patterns and themes.

For the third round the scope was narrowed to a focused observation (Spradley, 1980) looking for contrasts in the cases; concentrating on student activities and projects. Written notes were transcribed into Microsoft Word, read and reread, and added to the domain analysis, and constantly compared to check patterns and themes. Interviews completed during the third round were transcribed and added to the field notes from the observations to be analyzed for patterns and themes.

The process of data analysis can be summarized into three activities: data reduction, data display, and conclusion drawing and verification (Miles & Huberman, 1994). Upon completing all rounds of observations data reduction began with organizing chunks of data into categories for coding (Miles & Huberman) in NVivo2.0 software (2002). Data analysis continued with immersion in the data to determine patterns of behavior and cultural themes. Individual case reports were coded into the categories of (1) beliefs, (2) context factors, and (3) practices, specified in the central research question.

Qualitative computer software, NVivo2.0 (2002), was used to develop tree nodes (thoughts and definitions about data, along with selected passages of text) to create ideas, concepts, categories about the data, and code all relevant data. Coding was viewed and reviewed to see ideas develop. It was important to identify the evidence to support assertions and have the evidence triangulated from varied sources of data collection.

With the constant comparative method subset categories began to emerge. Subset categories emerging under beliefs were (1) technology as a tool and (2) technology and student learning. Subset categories emerging under context factors were (1) intrinsic and (2) extrinsic. Practices were first coded into subset categories using preset labels from the observation tool; class organization, teacher role, teachers' use of technology, students' use of technology, and students' level of technical skills. Categories that emerged under these subset practices were (1) teacher and (2) student. Conceptual frameworks evolved and developed (Miles & Huberman, 1994) that showed the representation of the interconnected components that led each teacher to integrate technology.

Findings

Cross-case analysis began by creating a meta-matrix (see Appendix A), assembling data from each case, to verify cultural themes and pattern clarification. Using the variable-oriented analysis (Miles & Huberman, 1994) the variables specified in the central research question, beliefs, context factors, and practices, were used. Looking across blocks of columns the researchers were able to make comparisons and contrasts across variables. A conceptual framework evolved that showed the representation of the common components that led study teachers to integrate technology.

Adoption and use of technology in the classroom is determined by teachers' attitudes and beliefs. Winnie, Sabrina, and Suzie believe that technology is a tool that can be used to enhance lessons. They each have a personal interest in using technology and believe technology integration in the classroom enhances student learning. Technology in their classrooms appeared seamless and was integral to lesson objectives. Winnie said, "It

is not an add-on that is stuffed or forced into a lesson." They reported that students were excited about technology and enjoy using it. Suzie said, "It is a motivator: It strikes their interest and keeps their attention." Sabrina said, "Using technology results in quality projects."

Winnie, Sabrina, and Suzie apply for grants and enter contests in hopes of receiving additional hardware and software for classroom use because of their personal interest in technology. They applied for the I-TEC grant by submitting an application that described an innovative technology activity already implemented in their classroom. In addition, they had to describe significant change within the classroom that would affect student achievement. Winnie and Sabrina submitted a project called "WISE" (We're Integrating Science Education), in which students interacting with peers would compare and contrast wetland environments. Suzie and her partner proposed a lesson called "Mission: Possible," in which students were active learners and peer mentoring was a large part of the project.

A teacher's skill in using computers has an impact on how they are used and their role in the classroom. Technology use by the teacher helps articulate the teacher's knowledge and helps in preparing for the use of and supporting technology in student learning. All three teachers reported that their computer skills were self-taught, while Louisiana INtegration TECHnology training (an intense, content-rich, 60-hour professional development model and framework for integrating technology) was key to technology integration. As I-TEC (Implementing a Technology-Enriched Curriculum) teachers new technologies are learned with ongoing professional development in the Blackboard Learning System.

The entire school district uses software set up through the district office for entering absences, tardiness, and uniform violations. The three teachers must enter absences each morning during homeroom. The district also has furnished each teacher with an email account, which they check periodically during the day, when time allows. The I-TEC teachers have access to Blackboard software that they use for posting assignments, templates, and students' work.

Technology has had a positive impact on these teachers by bringing change to their teaching strategies and classroom management. Winnie said, "Now we just dive in and see if it works. Some days it's bad, and some days it's great." Sabrina felt her teaching has moved from a traditional style to a new level. She said, "It re-motivated me in my teaching skills." Suzie said, "I learned a lot about computers from the students." An important feature of these exemplary technology teachers is the emphasis placed on creating learner-centered classrooms. Suzie said, "I try to give students choices." Winnie thought students should have a say in planning lessons with technology. She found, "Students learn and have more ownership when they drive the lesson, and they have done an excellent job for the most part."

Winnie, Sabrina, and Suzie provided rich learning environments and experiences with project-based learning activities that shift away from the classroom practice of short, isolated, teacher-centered lessons. They were less worried if students were learning because they improved their teaching with new ideas, new lessons, visuals, hands-on activities, multiple activities for each lesson, and new levels of teaching. These teachers are an essential element in the effectiveness of technology in their classroom. The extent and time to which the computer is used depends on flexibility in their planning and their

teaching style. Winnie, Sabrina, and Suzie were not afraid to take risks and many activities are completed by trial and error. Sabrina said, "I may plan a lesson and think it will take three to four days and it could take two weeks."

Winnie's students were learning with multiple activities for each lesson, and completed work on the computer or at their seat. Her class was structured as a cooperative learning environment at all times. The groups of students that made up a table in the class were intergroups in a whole class setting that had chosen names and assigned roles to the members. They set class goals as well as group and individual goals. Within the class structure Winnie used multiple types of grouping for student projects. Students worked alone as individuals, they worked in small groups, and they worked as a whole class.

All students had equal access and time on the computers. Students took responsibility for rotating to the computers using posters of computer times, group colors, and group names. As students entered the classroom they collected their portfolios from colored bins. They immediately moved to assigned seats and began working. Students worked at their own pace: So all the students were not working on the same activity at the same time. Students were allowed to be independent and were responsible for themselves and their work.

Winnie assumed a variety of roles during class time. The two roles she assumed most often were interactive director and facilitator/coach. She became an interactive director when leading a discussion and asking for students' responses. As students worked in groups interacting with one another and the materials, Winnie assumed the role of facilitator/coach, walking around the class clarifying, engaging, and motivating students.

Winnie used Microsoft PowerPoint software to show an anticipatory assignment as students enter the classroom. She called this assignment, "Science Pop." She also used Microsoft PowerPoint presentations and Inspiration software to lead students through a discussion with questions and then asking for students' responses, and to introduce students to new projects. Previously, searching the Internet to find sites she was able to identify appropriate, curriculum-related websites, and bookmark them into the "Favorites" folder for student use. Winnie created checklists and rubrics using Microsoft Word and gave them to students before assigning and completing a project-based activity: so they have a guide for planning their project design.

Clearly students knew how to operate the hardware and software they were expected to use, and Winnie was available to assist any students that had problems. She demonstrated one or two computer commands with each assignment, but did not spend much time teaching computer skills. This was accomplished with peer work and peer tutoring. Students were observed using Microsoft PowerPoint to create Pictionary presentations with new science vocabulary words: They charted their grades with Graph Master Software and walked around the school taking pictures of energy sources with a digital camera, beginning a lesson on energy conservation.

Because MBM Middle School has a computer lab for teacher and student use Sabrina was able to plan some lessons so her students worked individually to complete projects. Working in the computer lab allowed each student to have his or her own computer to complete the assignment. Once she set up the learning situation Sabrina

assumed the role of facilitator/coach walking around the class or lab clarifying, engaging, and motivating students.

Sabrina began class with a Microsoft PowerPoint presentation running on the computer and projected onto the whiteboard. She played the presentation in a loop to allow all students time to record the information in their portfolio. She called her presentation the "Daily Agenda" because it was a list of activities and assignments for the day. She said, "This is one way parents know what students are doing in class." She also had students record a table of contents of projects and assignments in their portfolios. Sabrina created rubrics with Microsoft Word to guide students in completing all projects.

Using the Internet in the computer lab Sabrina's students worked individually to complete a research project on an assigned disease. She identified appropriate, curriculum-related websites for students to use, but also allowed them to use Internet search engines,

"Ask Jeeves" and "Google." After students completed research they prepared an oral presentation with a visual aide, in which they were given a choice of a poster, a Microsoft PowerPoint presentation, a brochure/pamphlet, or info commercial. Students made the following choices:

- Six students used Microsoft Word to create brochures.
- Three students used Microsoft Word to create a poster.
- Thirty-eight students used Microsoft PowerPoint to create a presentation.
- Eleven students did not use technology, they hand wrote and colored a poster or brochure.
- Two students completed the info commercial shooting their video at home.
- A few students were required to hand write a note explaining why they chose not to complete the assignment.

Suzie used a teacher-facilitator approach for project-based learning and integrating technology and science into her Applied Technology class. Learners accessed and utilized technology to assist them in the inquiry process. Once Suzie presented an assignment, giving instructions and a brief demonstration, students worked at their own pace to complete assignments.

Suzie began a lesson with a Microsoft PowerPoint presentation and her Blackboard site for lesson introduction and demonstrations. Beginning on Monday students spend approximately twenty minutes in traditional student desks receiving an introduction to a new lesson. As the week progresses students come into the classroom and proceed straight to the computers. Suzie has determined that students need a certain amount of instructional time before allowing them to work on their own. She says, "On Monday I give more instruction with students sitting in a whole group, and by Friday students are working independently."

This particular nine-week period Suzie taught seventh graders and her lessons included projects designed to increase awareness of the need to protect the wetlands. Students were supplied with handouts, web links for web searching, a Wetlands CD, social studies and science textbooks, and encyclopedias to complete research of the wetlands. Students used Microsoft Word to type a three-paragraph article using the research data. Using Paint software students illustrated something he or she found

interesting about their topic. Microsoft Publisher was used to create a newsletter style publication and included graphics obtained from the Internet. Students used Microsoft PowerPoint to create a presentation to teach others what they learned. Using Microsoft FrontPage Express each student created a homepage with links to all the projects completed on the wetlands. Hollywood High, interactive theater software, was used to write, direct, and produce a virtual theater production about the wetlands.

Suzie used multiple types of grouping patterns, allowing students to choose their own partner when working in pairs. If students were placed into small groups Suzie assigned students to groups. Students' level of technical skills was mostly independent; however, Suzie walked around assisting any student having problems. Her strategy for assisting students was to refer them to a handout with the instructions or to another student for help. She constantly reminded students to turn in completed assignments, which were also listed on the whiteboard for all students to see.

The purpose of students' use of technology was to engage them in authentic tasks. They can learn technology skills in the context of the lesson objectives. Sabrina believed in "teaching the curriculum, not the technology." Students' level of technical skills for all three teachers was a resounding independent. Clearly students knew how to operate the hardware and software they were expected to use and strategies were in place to assist any student with problems so work did not slow down. Peer tutoring was encouraged by all three teachers and students never hesitated to ask another student for help. Sabrina said, "Peer tutoring has been a great way to boost confidence of some of my students."

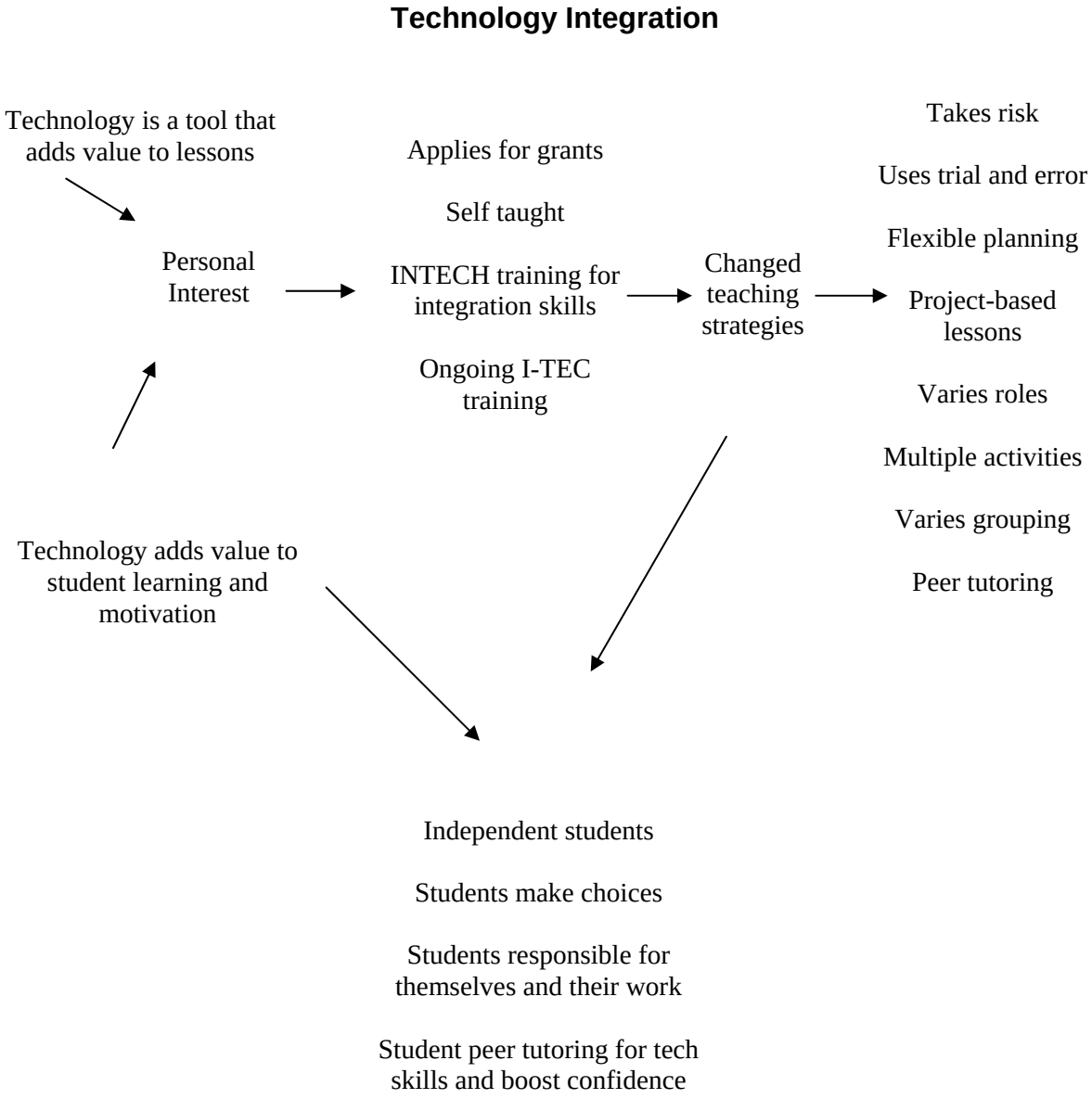
These teachers turned over learning to the students and students took ownership and responsibility for their work and learning. Students were active, autonomous, and highly engaged with the content under study. Winnie, Sabrina, and Suzie created opportunities for students to work collaboratively, solve problems, and share knowledge and responsibility. In order to help students take ownership for their learning, they were allowed to have choices and were encouraged to be creative. They were allowed to use a variety of computer software including: Microsoft PowerPoint, Microsoft Word, Microsoft FrontPage, Microsoft Producer, Microsoft Publisher, Paint, Blackboard, Internet websites, and search engines. Students completed a variety of products using paper and pencil and computer software. Computer-generated products include: brochures, newspapers, presentations, reports, pictionaries, bumper stickers, and web pages. Physical objects in the room are arranged to afford a different kind of learning environment and students changed places as needed to complete assignments.

Identifying common components of the teachers in this study deepens the understanding of what leads teachers to integrate technology for a technology-rich curriculum. The common components in the model (see Figure 2) illustrate the relations between variables. All three teachers believe technology is a tool that adds value to lessons and adds value to student learning and motivation. Winnie believed that with technology integration she reached a variety of learning styles and addressed the needs of students with different abilities. "I have a lot of kids that are considered academically low and they will blossom using computers." She also said, "Students are more interested when they can get on the computer then when we are just opening a book."

Sabrina found students were more willing to come in at lunchtime, before school, and after school to complete assigned projects. "Students are more into quality of projects, especially when they see other students and what they are able to do, it makes

them more interested in improving their own skills." Suzie believes, "computers should be used in conjunction with the digital cameras, video streaming and editing." She teaches students to use computers as a tool.

Figure 2. Representation of the common components of study teachers integrating technology.



These beliefs contribute to a personal interest that motivates these teachers to apply for grants, teach themselves new technologies, and attend training. Most of the time Winnie solves problems with trial and error. Winnie said she likes to learn things on her own, "I'm one of these kind of people who learns things on my own." Through a "personal desire" and "personal interest" she learned to integrate technology with one or two computers. Winnie said the school administration is very supportive, "One thing the school does in helping me is to allow me to go to any conferences or training that we have money available for." Sabrina said, "INTECH was probably one of the biggest changes as far as my computer integration goes." Suzie writes grants to get more computers and said, "I participate in anything that may get me a computer or two." She also enters contests, and has the students enter contests. When they win, they may get a couple of computers.

Because Winnie, Sabrina, and Suzie believe technology adds value to student learning and motivation they have changed their teaching practices allowing students to be independent, make choices, and be responsible for themselves and their work. They have incorporated peer tutoring to help students with technology skills, which boost student confidence. They are willing to take risks, use trial and error, be flexible with planning, prepare project-based lessons, prepare multiple activities, vary roles, and encourage peer tutoring.

Discussion

The three teachers in this study have diverse backgrounds; vary in age and years of classroom experience. Their teaching schedules are very different; the number of classroom computers and classroom settings are also very diverse. Techniques for rotating students to computers vary depending on the assignment. Their classroom environments are such that computers were prominent and appear seamless in student activities. It is obvious that the technology is integral to student learning and lesson objectives and not merely an add-on. Winnie, Sabrina, and Suzie used technology to enhance lessons and take their curriculum in new directions. One important change they have made is to be flexible, realizing sometimes, "lessons work and sometimes they don't." Winnie, Sabrina, and Suzie are exemplary technology teachers overcoming barriers and implementing classroom practices that lead to a technology-enriched curriculum.

Wetzel and Zambo (1996) described a model classroom as using technology in ways that support curriculum standards that call for problem solving, communication, reasoning, and establishing connections among major curriculum areas. In the classrooms visited for this study, technology was used as a tool to support students in performing authentic tasks; students participated in defining their goals, making design decisions, and evaluating their progress. Classes were organized around complex, authentic tasks that lie in the goals and content of the activity, as designed by the teacher, not in the use of the technology.

Technology used as tools can help students show what they know through methods other than a traditional test or written product. One core belief that evolved from analysis of data in this study is that the teachers believed technology is a tool that lends itself to better student learning outcomes. Teachers' personal beliefs about the role of

technology helped to shape their goals for technology use. If teachers are not convinced that student outcomes will improve through the use of technology, they have less incentive to incorporate it (Ertmer et al., 1999). Winnie, Sabrina, and Suzie believe technology can be used to enhance lessons. They each have a personal interest in using technology and believe technology integration into the classroom enhances student learning.

Teacher planning time is a key underlying context factor in determining the extent to which technology gets used. Shelly, Cashman, Gunter, and Gunter (1999) reported that one of the most important variables for good instruction and technology integration demands a great deal of planning. Winnie found it hard to plan when she first began integrating technology. Now she uses the quality management process in her class, in which students help with the lesson planning and guide their own learning. Sabrina stays at school until 5:00 p.m. each afternoon planning her lessons and preparing the classroom environment; however, she remains flexible to meet student needs and technical difficulties. By the time school starts Suzie has her lessons, activities, and projects ready to go, preparing all materials during the summer. Lack of time for planning the use of computers has not been a problem for these teachers.

A large body of literature supports the idea that the biggest obstacle to teachers using technology in their classrooms is the lack of adequate teacher training (Yildirim, 2000). Despite training some teachers are still hesitant and not ready to embrace technology. The three teachers in this study began using computers because of a personal interest. They eventually went through Louisiana INTECH, an intense, content-rich, 60-hour professional development model and framework for integrating technology. In addition, as an I-TEC teacher they receive ongoing professional development as part of the grant.

Support for technology is necessary at the state, district, and school levels. Administrators should discuss with staff how technology can best be used to enhance teaching and learning (Slowinski, 2000). Professional development and grant opportunities are provided for these teachers at the district level. At the school level teachers are given release time to attend trainings and conferences. These teachers are encouraged to take a leadership role and are invited to share their ideas about instruction with colleagues at faculty meetings and state conferences. Other teachers are encouraged to observe how these teachers have implemented their student-centered and student-directed visions within realistic environments in which technology is one component.

Winnie, Sabrina, and Suzie are an essential element in the effectiveness of technology in their classroom. Ryba and Brown (2000) described proficient computer-using teachers as having a strong commitment to learner-centered approaches. The teachers in this study took a learner-centered approach in which their students took responsibility for their learning and behavior. The Apple Classrooms of Tomorrow [ACOT] project (Dwyer, Ringstaff, & Sandholtz, 1990) identified five stages of instructional evolution for technology integration: entry, adoption, adaptation, appropriation, and invention. The findings of this study show these three exemplary technology teachers are at the invention stage where they are experimenting with new instructional patterns and ways of relating to students. They are using project-based instruction and individually paced instruction. Their students have high levels of skill

with technology, an ability to learn on their own, problem solve, and collaborative work patterns.

Winnie, Sabrina, and Suzie have students work on long-term projects; work in collaborative learning groups; and the teacher acts as the facilitator/coach for projects rather than as transmitter of information. Student projects, such as pictionaries, wetland brochures, disease research, energy source identification, and whodunit mysteries, generally extend over several days or weeks and require more time than more traditional lecture, textbook, or worksheet-based classroom activities. Winnie's students took their energy conservation project to the community acting as change agents in society. Sabrina's students researched diseases and presented their findings. Suzie's students created productions of wetland environments. Students moving to computers, using Internet files, and accomplishing significant project-based activities takes time. These teachers have restructured the way they use time in the classroom to make long-term projects possible by taking risks, using trial and error, being flexible, creating multiple activities, and varying grouping.

Students take pride in their technology projects and the computer allows revisits for easy modification to revise and refine. Technology increases student motivation, heightens their self-esteem, and lends itself to a greater sense of accomplishment and power. Students in the classes observed for this study actively made choices about how to generate, obtain, manipulate, or display information.

Students who are tech savvy are usually eager to share their knowledge with others. The teachers in this study had students act as peer coaches for each other, offering advice when a peer had trouble achieving a desired result with the software. Advice giving was continued when students worked together in small groups, but was also common among students working individually on computers. Student coaching roles for the most tech savvy students were set up formally at the beginning of school; however, new coaches emerged naturally as part of the technology-based activities in the classroom.

As shown in Figure 2, when teachers believe technology is useful, have a personal interest, and are provided with support and training; teachers and students get excited, and use technology successfully to promote learning and achievement in the classroom. Active involvement in technology-supported innovations was a source of inspiration and professional renewal for these teachers. These teachers see technology as a tool for achieving their vision of teaching and learning.

The teachers in this study are not afraid to take risk using trial and error. With trial and error one learns by making mistakes and seeing how these mistakes bring about results that are not necessarily those that were anticipated. These teachers have a personal commitment and courage to try new things. Winnie called her class "controlled chaos."

Conclusions

Educational technology is used by teachers to create rich learning environments and experiences with project-based learning activities that shift away from the classroom practice of teacher-centered lessons. Teachers can use technology to improve their teaching with new ideas, new lessons, visuals, hands-on activities, and new levels of teaching. The extent and time to which the computer is used depends on flexibility in

planning, creating multiple activities, and always having backup plans for technical difficulty. Flexibility allows for student differences in each class. Trying to keep multiple projects and assignments going at the same time involves risks. Organization and flexible planning are important elements with this teaching style. It is important to have a non-technology based backup plan in case of equipment problems and have materials available at a moment's notice.

Teachers' beliefs about classroom practice appear to shape their goals for technology. This study adds to the literature surrounding technology integration with a perspective on beliefs about computer technology as a tool for teaching and learning. To successfully implement the integration of a new technological tool, consideration of what the implementation will mean to teachers' personal beliefs must be investigated.

Support for technology integration is necessary at the state, district, and school levels. Ongoing professional development and grant opportunities should be provided for teachers from all levels. At the school level teachers need release time to attend trainings and conferences. Teachers should be encouraged to take a leadership role and be invited to share their ideas about instruction with colleagues at faculty meetings and state conferences. Other teachers should be encouraged to observe how teachers have implemented their student-centered and student-directed visions within realistic environments in which technology is one component.

Exemplary use of technology is not widespread. For this reason, experiences and perceptions of staff from studies are a great interest to a broader educational community and to the general public. This study had a small number of participants in a large school system. Participants all resided within a fairly small geographical area. More successful technology use in the classroom across all subject areas should be observed and reported. It would be useful to follow teachers at various points in their journeys of technology integration in order to highlight effective strategies for moving forward. More research needs to be done to further investigate why teachers still have barriers to integration of technology. A study of personalities of teachers identified as exemplary technology leaders would be valuable. Future research should be done with teachers who are not identified as exemplary technology teachers to confirm or disconfirm the findings.

A teacher's challenge is to create a classroom that supports students' inherent ability to learn. This study attempted to go beyond the number of available computers to describe in detail how these exemplary technology teachers were using computer technology to establish a socially interactive and reflective community of practice in their classroom, and their beliefs and context factors affecting technology use. The study adds to the literature surrounding technology integration with a perspective about computer technology as a tool for teaching and learning.

References

Anderson, R. E., & Dexter, S. L. (2000). *School technology leadership: Incidence and impact.* (Tech. Rep. No. 6). University of California at Irvine: CRITO.

Ary, D., Jacobs, L. C., & Razavieh, A. (1996). *Introduction to research in education* (5th ed.). Orlando, FL: Harcourt Brace College Publishers.

Barron, A. E., Kemker, K., Harmes, C., & Kalaydjian, K. (2003). Large-scale research study on technology in K-12 schools: Technology integration as it relates to the

national technology standards. *Journal of Research on Technology in Education, 35*(4), 489-507.

Becker, H. J., & Riel, M. M. (2000). *Teacher professional engagement and constructivist-compatible computer use.* (Tech. Rep. No. 7). University of California at Irvine: CRITO.

Berg, S., Benz, C. R., Lasley, T. J., & Raisch, C. D. (1998). Exemplary technology use in elementary classrooms. *Journal of Research on Computing in Education, 31*(2), 111-122.

Boethel, M., & Dimock, K. V. (1999). *Constructing knowledge with technology: A review of the literature*. Austin, TX: Southwest Educational Development Laboratory [SEDL].

Byrom, E. (1998). *Factors influencing the effective use of technology for teaching and learning: Lessons learned from the SEIR*TEC intensive site schools*. Greensboro, NC: Southeast and Islands Regional Technology in Education Consortium.

Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

Cuban, L. (2001). *Oversold & underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.

Dockstader, J. (1999). Teachers of the 21st century know the what, why, and how of technology integration. *T.H.E. Journal, 26*(6), 73-74.

Doherty, K. M., & Orlofsky, G. F. (2001). Student survey says: Schools are probably not using educational technology as wisely or effectively as they could. *Education Week, 20*(35), 45-48

Dwyer, D. C., Ringstaff, C., & Sandholtz, J. H. (1990). *Teacher beliefs and practices. Part 1: Patterns of change. The evolution of teachers' instructional beliefs and practices in high-access-to-technology classrooms. First-fourth year findings.* (Report No. 8). Cupertino, CA: Apple Classrooms of Tomorrow, Apple Computer.

Ertmer, P. A., Addison, P., Lane, M., Ross, E., & Woods, D. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom. *Journal of Research on Computing in Education, 32*(1), 54-72.

Franklin, T., Turner, S., Kariuki, M., & Duran, M. (2001). Mentoring overcomes barriers to technology integration. *Journal of Computing in Teacher Education, 18*(1), 26-31.

Hadley, M., & Sheingold, K. (1993). Commonalities and distinctive patterns in teachers' integration of computers. *American Journal of Education, 101*, 261-315.

Honey, M., Culp, K. M., & Carrigg, F. (1999, July). *Perspectives on technology and education research: Lessons from the past and present*. Paper presented at the meeting of the Secretary's Conference on Educational Technology, Washington, D.C.

International Society for Technology in Education (ISTE). (2000a). *National educational technology standards for students [NETS*S]*. Eugene, OR: Author.

International Society for Technology in Education (ISTE). (2000b), *National educational technology standards for teachers [NETS*T]*. Eugene, OR: Author.

Jaber, W. W., & Moore, D. M. (1999). A survey of factors which influence teachers' use of computer-based technology. *International Journal of Instructional Media, 26*(3), 253-266.

Kinnaman, D. E. (1994). What it really means to integrate technology. *Technology & Learning, 14*(8), 130-131.

Kozma, R. (2003). Technology and classroom practices: An international study. *Journal of Research on Technology in Education, 36*(1), 1-14.

Lumpe, A. T., & Chambers, E. (2001). Assessing teachers' context beliefs about technology use. *Journal of Research on Technology in Education, 34*(1), 93-107.

Marshall, C., & Rossman, G. B. (1999). *Designing qualitative research* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Miles, M. B., & Huberman, A. M. (1994). *An expanded sourcebook: Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Mouza, C. (2002). Learning to teach with new technology: Implications for professional development. *Journal of Research on Technology in Education, 35*(2), 272-289.

Norris, C., Sullivan, T., Poirot, J., & Soloway, E. (2003). No access, no use, no impact: Snapshot surveys of educational technology in K-12. *Journal of Research on Technology in Education, 36*(1), 15-27.

NVivo2.0 (2002). (Version 1.3) [Computer Software]. Doncaster, Victoria, Australia: QSR International Pty Ltd.

Painter, S. R. (2001). Issues in the observation and evaluation of technology integration in K-12 classrooms. *Journal of Computing in Teacher Education, 17(*4), 21-25.

Parsad, B., & Jones, J. (2005). *Internet access in U.S. public schools and classrooms: 1994-2003* (Report No. NCES 2005015). *U.S. Department of Education*. Washington, DC: National Center for Education Statistics.

Patton, M. Q. (1990). *Qualitative evaluation and research methods.* (2nd ed.). Newbury Park, CA: Sage Publications.

Ronnkvist, A. M., Dexter, S. L., & Anderson, R. E. (2000). *Technology support: Its depth, breadth and impact in America's schools.* (Tech. Rep. No. 5). University of California at Irvine: CRITO

Rother, C. (2003). Technology's value in education. *T.H.E. Journal, 31*(4), 35-38.

Rups, P. (1999). Training instructors in new technologies. *T.H.E. Journal, 26*(8), 67-69.

Ryba, K., & Anderson, B. (1993). *Learning with computers: Effective teaching strategies.* Eugene, OR: International Society for Technology in Education (ISTE).

Ryba, K., & Brown, M. E. (2000). How proficient IT teachers integrate computers into the curriculum. *Journal of Computing in Teacher Education, 16*(4), 6-11.

Sage, S. M. (2000). A natural fit problem-based learning and technology standards. *Learning & Leading with Technology, 28*(1), 6-13.

Shelly, G. B., Cashman, T. J., Gunter, R. E., & Gunter, G. A. (1999). *Teachers discovering computers: A link to the future*. Cambridge, MA: Course Technology.

Silverman, D. (2000). *Doing qualitative research: A practical handbook.* Thousand Oaks, CA: Sage Publications.

Slowinski, J. (2000). *Becoming a technologically savvy administrator.* Eugene, OR: ERIC Clearinghouse on Educational Management. (ERIC Document Reproduction Service No. ED438593)

Smerdon, B., & Cronen, S. (2000). *Teachers' tools for the 21st century: A report on teachers' use of technology* (Report No. NCES 2000102). U. S. Department of Education. Washington, DC: National Center for Education Statistics.

Spradley, J. P. (1980). *Participant observation*. Orlando, FL: Harcourt Brace Jovanovich.

Staples, A., Pugach, M. C., & Himes, D. (2005). Rethinking the technology integration challenge: Cases from three urban elementary schools. *Journal of Computing in Teacher Education. 37*(3), 285-311.

Tiene, D., & Luft, P. (2001). Classroom dynamics in a technology-rich learning environment. *Learning & Leading with Technology*, 29(4), 11-13, 60.

Titterington, L. (2000). 12 small steps toward change. Reality of change. *ENC Focus, 7(1), 38-39.*

Tomei, L. A. (1999). The technology façade. *Syllabus, 13*(2), 32-34.

Vannatta, R. A., & Fordham, N. (2004). Teacher dispositions as predictors of classroom technology use. *Journal of Research on Technology in Education, 36*(3), 253-272.

Wetzel, D. (2002). A model for pedagogical and curricular transformation with technology. *Journal of Computing in Teacher Education, 18(2*), 43-49.

Wetzel, K., & Zambo, R. (1996). Innovations in integrating technology into student teaching experiences. *Journal of Research on Computing in Education, 29(2),* 196-198.

Yildirim, S. (2000). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education, 32*(4), 479-495.

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Appendix A

Technology Integration

Meta-Matrix Analysis across Cases

Teacher	Beliefs		Context Factors		Practices	
	Tool	Learning	Intrinsic	Extrinsic	Teacher	Students
Winnie	Enhances lesson Any # of computers	Students have say Address students' needs	Personal interest	Ongoing training Release time Grants	Creates variety of activities Assumes variety of roles Varies grouping Technology	Set goals Independent Responsible Technology skilled

Suzie	Use with cameras, streaming, editing	Use as tool Motivator Keeps mind active	Trail and error Utilize student knowledge	Ongoing training Grants Contests	Creates variety of activities Assumes variety of roles Varies grouping Technology expert Creates how to handouts skilled Takes risks	Independent Responsible Peer tutor Use handouts
Sabrina	Motivator Grading easier Communication Enhances lessons	Quality work Extends work time	Flexible Motivated	Ongoing training Release time Grants Tech support Student tech skills More teachers using	Creates variety of activities Assumes variety of roles Varies grouping Technology skilled Takes risks Backup plan	Independent Responsible Technology skilled Peer tutor

Teacher	Beliefs		Context Factors		Practices	
	Tool	Learning	Intrinsic	Extrinsic	Teacher	Students

Author Note

Julie Angers recently completed her Ph.D. in Human Resource Education and Workforce Development, with a minor in Educational Leadership, Research & Counseling at Louisiana State University, Baton Rouge, LA. She is a dedicated, resourceful education professional with a proven ability to provide strategies that can substantially increase the knowledge and teaching skills of teachers. She has 11 years of achievement in technology teaching and training with a professional development focus. She can be reached by email jangers@cox.net

Krisanna L. Machtmes (Ph.D. Purdue University, 1998) is an assistant professor in the School of Human Resource Education and Workforce Development, at the Louisiana State University in Baton Rouge, Louisiana. Her research areas comprise both quantitative and qualitative research methodology, and program evaluation. She teaches courses in research methodology, program evaluation, and introductory and advanced qualitative research methods. Dr. Machtmes can be reached at 225-578-6194 or kmachtmes@agctr.lsu.edu.

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