Integrating a technology-enriched curriculum: ethno-case study

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INTEGRATING A TECHNOLOGY-ENRICHED CURRICULUM
ETHNO-CASE STUDY

A Dissertation

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

in

The School of Human Resource Education and Workforce Development

by
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ABSTRACT

The purpose of this qualitative study was to provide an examination of beliefs, context factors, and practices of exemplary teachers that lead to a technology-enriched curriculum. Three middle school teachers participated. Using both direct and participant observation the Spradley model 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 parish website. This research provides: (1) up-to-date information on what and how educational technology is used today; and (2) information which gives other educators an understanding of what beliefs and context factors influence teachers to integrate technology into their 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. Students are allowed to make choices, be independent, and take responsibility for themselves and their work.
CHAPTER 1

INTRODUCTION

Rationale for the Study

Today’s classroom teachers must be prepared to provide technology-supported learning opportunities for their students (International Society for Technology Education [ISTE], 2000b). The emphasis in schools has been on individual learning and performance—what students can do by themselves without the aid of other students or external supports, such as books, notes, calculators, and computers. This approach to schooling served well when the production economy demanded a large number of graduates who could read, write, perform simple computations, but most of all take direction from supervisors (Kozma & Schank, 1998).

The twenty-first century has shown to make different demands on students and schools. Schools face the challenges of preparing students to live, learn, and work successfully in today’s knowledge-based, digital society (Waxman, Connell & Gray, 2002). In commerce, manufacturing, multinational corporations and individual households, computer technology has altered how business is conducted and how people communicate. Technology must be integrated into the curriculum to help students become capable technology users, information seekers, problem solvers, and effective communicators. Teachers have to work toward encouraging students to become critical thinkers, collaborative colleagues, and technology-literate citizens (Sage, 2000).

The availability of computers and other technology in schools has increased rapidly in recent years, causing concern and questions for educators and policy makers about the use and impact of computers in schools. Educators continue to debate the use and value of technology as an instructional tool. Understanding the role of technology in classrooms requires the understanding
of the role and importance of technology in the real world. Technology should support curriculum standards that call for problem solving, communication, reasoning, and establishing connections among curriculum areas.

Recent research indicates that there are few teachers who are described as exemplary in their use of computers for instruction and learning (Jaber & Moore, 1999). Exemplary technology teachers have a sound understanding of pedagogy, as well as specialized skills and knowledge of using computers in the classroom. Ryba and Brown (2000) defined a proficient computer-using teacher as one who sought to establish a socially interactive and reflective community of practice within their classrooms. They identified Barry as a proficient computer-using teacher in a 2000 study conducted to analyze the ways in which computers were being used to create conditions for better learning. “Barry sees himself as a facilitator who, like the conductor of an orchestra, keeps everyone together and creates opportunities for the students to perform and release their talent” (Ryba & Brown, 2000, p. 7).

The ISTE report (2000b) states that today’s classroom teachers must be prepared to empower students with the advantages technology can bring. 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 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.

Teachers cannot escape the fact that today’s classrooms must provide technology-supported learning. However, if the technology is utilized and how the technology is integrated is dependent upon the individual teacher. 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. It is obvious that teachers possess beliefs regarding technology use and that these beliefs are most likely to influence how they see their role in the classroom (Ertmer, Addison, Lane, Ross, & Woods, 1999). Beliefs and practices of teachers suggest that the effective use of educational technologies can have a number of positive impacts on educational processes, outcomes, and student performance (Lumpe & Chambers, 2001).

It is common to observe different teachers integrating technology with varying pedagogical styles. Some teachers choose to maintain a tight control over students, while other teachers are comfortable allowing students to work independently and select software according to student needs. Focused observations of teachers implementing technology integration can bring insight into teachers’ practices. Observation alone will not indicate why the teacher has chosen to integrate technology, so interviewing teachers will help to better understand teachers’ beliefs and context factors that affect technology integration.

A few studies have used classroom observation to investigate technology use in classrooms, but they have been informal or evaluative studies designed to evaluate effects of specific interventions (Waxman & Huang, 1995). Because of the criticisms of self-reporting assessments, which tend to be upwardly biased, it is important to observe the actual extent to which computers are integrated into the classroom environment. A qualitative approach to determine patterns of behavior and cultural themes in the use of technology in the classroom can provide scenarios of classroom practice that other teachers may emulate. Timed-interval observation tools pinpoint teacher and student performance during a lesson that integrates technology into the classroom. Studying beliefs and context factors of teachers using computers
will help to understand how to achieve technology integration. Serious educational reform targets cognitive changes in students’ thinking and this can be accomplished by properly integrating technology into the classroom curriculum.

**Statement of the Problem**

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. Early studies on technology and education sought to demonstrate the impact of technologies or software on student learning and were tied very specifically to the particular technologies used by the subjects of the study (Honey, Culp, & Carrigg, 1999). The results from a number of published studies on the relationship between computer use and academic achievement indicate that technology can bolster student outcomes (Becker, 1994; Kozma, 2003; Kulik, 2003; Page, 2002; Rother, 2003). “The most published research articles describe methods of getting students or faculty more involved with a technology (e.g., the Internet) or how to structure training and other conditions to get them more interested in using technology in general” (Roblyer & Knezek, 2003, p. 68). Much of the existing data on how technology is used in classroom settings relies primarily on self-reporting of teachers without corroborating data (Roblyer & Knezek, 2003).

Missing from the research is evaluative data obtained from prolonged observations in a classroom setting of technology integration into the curriculum. Because the existing data relies on self-reporting of practices, there is a lack of understanding of how teachers’ beliefs about the role of technology affect technology integration into the curriculum. 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. It is also important to examine context factors that influence teacher’s use of computers for teaching.
The Purpose of the Study

The primary purpose of this study was to provide a qualitative examination and quantitative analysis of exemplary technology teachers participating in the Integrating a Technology-Enriched Curriculum (I-TEC) Model Classrooms in a Louisiana Public School District. For this study an exemplary technology teacher is 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 process 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?

The information gathered from this study using direct and participant observations and in-depth interviews provides: (1) up-to-date information on what and how educational technology is used today; and (2) information which gives other educators an understanding of what beliefs and context factors influence teachers to integrate technology into their curriculum.

Information gathering at the exploratory stage of this study helped to develop an understanding of how and why these exemplary teachers were chosen to participate in the I-TEC Model Classrooms and how these teachers have evolved in their use of technology. Data collection began with a one-on-one interview with the Tech Center Technology Coordinator and Grant Coordinator during which the following questions were asked: (1) Why were these particular teachers chosen to participate in this grant? (2) How were they incorporating technology prior to the grant?
Eight questions were asked in a one-on-one interview with each teacher to further investigate their backgrounds and beliefs:

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 specific practices in your school or district that have been instrumental in helping to integrate technology into your classroom?

8. How did you manage your preparation time for integrating technology?
CHAPTER 2
REVIEW OF RELATED LITERATURE

The purpose of this study was to explore beliefs, context factors, and practices of an exemplary technology teacher that leads to a technology-enriched curriculum. To place the study within the context of the relevant literature, this review begins with an overview of effective teaching practices to get a better understanding of pedagogy and exemplary teaching. This is followed by a review of science and technology in the middle school classroom. The next section is a review of the general subject of educational technology. Subsections deal with how educational technology has been observed and recommendations to integration into classroom instruction. These subsections fall into four categories: (1) technology integration, (2) a model classroom, (3) relationship between educational technology and learning, and (4) technology use in the classroom. The next area of literature review deals with what research reveals about teachers’ beliefs and the relationship to practices in the classroom and context factors affecting teachers’ use of technology. The final area of literature review deals with an overview of qualitative research.

Effective Teaching Practices

Stronge (2002) explains that effectiveness is an elusive concept when considering the complex task of teaching. He found that some researchers define teacher effectiveness in terms of student achievement, while others focus on high performance ratings from supervisors. Still others rely on comments from students, administrators, and other interested stakeholders. In an attempt to develop an understanding of what teachers do to cause significant student learning, researchers have begun to focus on the specific characteristics and teaching processes or pedagogy employed by the most effective teachers.
The online dictionary, A Lexicon of Learning, maintained by the Association for Supervision and Curriculum Development [ASCD] (2002) defines pedagogy as the art of teaching—especially the conscious use of particular instructional methods. For example, a teacher using a discovery approach rather than direct instruction is using a different pedagogy. In Classroom Instruction That Works, Marzano, Pickering, and Pollock (2001) postulate that effective pedagogy involves three related areas: (1) the instructional strategies used by the teacher; (2) the management techniques used by the teacher; and (3) the curriculum designed by the teacher.

Marzano et al. (2001) affirm the belief in which research will provide strong, explicit guidance for the classroom teacher. In their book they have compiled instructional strategies that have been extracted from the research base on effective instruction. These strategies can guide classroom practice in such a way to maximize the possibility of enhancing student achievement:

- Identifying similarities and differences
- Summarizing and note taking
- Reinforcing effort and providing recognition
- Homework and practice
- Nonlinguistic representations
- Cooperative learning
- Setting objectives and providing feedback
- Generating and testing hypotheses
- Questions, cues, and advance organizers.

Zemelman, Daniels, and Hyde (1998) in Best Practice: New Standards for Teaching and Learning in America’s Schools have defined a coherent paradigm of learning and teaching across
the whole curriculum. They present dozens of recommendations from important national bodies and share stories from exemplary classrooms. They found that exemplary teachers have basic ways of organizing students, time, materials, space and help. Among basic structures of management techniques and classroom structures are:

- Integrative units that involve coplanning with students. Teachers identify a few subjects of interest and importance, and then build extended units around these topics.
- Small-group activities where students work together effectively in small groups – in pairs, threes, ad hoc groups, and long-term teams-without constant teacher supervision.
- Representing-to-learn overcomes passivity, making students more active and responsible for their own learning.
- Classroom workshop allows students to choose their own topics for writing and books for reading, using large scheduled chunks of classroom time for doing their own reading and writing. They collaborate with classmates, keep their own records, and self-evaluate. The teacher takes the role of modeling their own reading and writing processes.
- Authentic experiences involve students in tangible, genuine, authentic, real-world materials and experiences.
- Reflective assessment shows how students perform the authentic, complete, higher-order activities that schools aim for: reading whole books, drafting and editing stories or articles, conducting and reporting a scientific inquiry, and applying math to real problem solving.

The traditional view of curriculum is as a sequence of topics or content. Curriculum designed by the teacher is concerned with making decisions about the scope, organization, and sequence of content. State education departments, school districts, and professional organizations set curriculum guides, competency lists, and content outlines. Teachers may then translate these general objectives into objectives for specific lessons (Zemelman et al., 1998).

An important facet of The Center for Research on Education, Diversity and Excellence [CREDE] has been the development of a pedagogy that has been proven to be effective in educating all students (Tharp, 1999). The five standards for effective pedagogy (see Table 1) do
not endorse a specific curriculum but, rather, establish ideals for best teaching practices that can be used in any classroom environment for any grade level or group of students.

Table 1

<table>
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<th>Standards</th>
<th>Outcome</th>
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<td>Teachers and students producing together</td>
<td>Facilitate learning through joint productive activity among teachers and students.</td>
</tr>
<tr>
<td>Developing language and literacy across the curriculum</td>
<td>Develop students' competence in the language and literacy of instruction throughout all instructional activities.</td>
</tr>
<tr>
<td>Making lessons meaningful</td>
<td>Connect curriculum to experience and skills of students' home and community.</td>
</tr>
<tr>
<td>Teaching complex thinking</td>
<td>Challenge students toward cognitive complexity.</td>
</tr>
<tr>
<td>Teaching through conversation</td>
<td>Engage students through dialogue, especially instructional conversation.</td>
</tr>
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With the definition of content standards and the public pressures of the accountability movement more districts and teachers are taking a closer look at research-based instructional practices that improve student motivation and achievement (Allen, 2002). A critical issue related to curriculum and instructional practices is technology integration. The curriculum should drive the technology; technology should not drive the curriculum. That is, teachers should use the appropriate technologies to enhance learning at the appropriate times (Shelly, Cashman, Gunter, & Gunter, 1999).

**Science and Technology in the Middle School**

The availability of instructional technology for teachers is increasing in middle school science to meet societal demands and goals. It is widely accepted that middle years learners have
unique characteristics that must be considered in planning instructional programs. Middle years learners demonstrate a wide range of development in the transition between concrete and abstract thinking, prefer active learning and interaction with peers during learning experiences, may show a strong need for approval, respond positively to real life contexts and situations, and show disinterest in conventional academics (National Middle School Association [NMSA], 2003). Middle school science educators are faced with the task of providing these students with a variety of methodologies of instruction and examining the impact to fully understand how the presence of technology affects student learning (Reid-Griffin, 2003).

The National Science Education Standards describe technology as a tool to help students appreciate the natural world and conduct inquiry projects (Natural Research Council [NRC], 1996). The role that technology does and should play in science education creates debate among educators, particularly concerning computer technologies. Most reform efforts in science education such as learning, and other forms of inquiry demand that students have access to the tools they need to answer their questions. Appropriately applied technologies can work in the science classroom (Reid-Griffin, 2003).

Reid-Griffin (2003) investigated how the presence of technological tools (Casio data analysis system) might affect students’ attitudes toward using advanced technologies to solve problems. She observed 23 middle school students participating in a structured set of activities, which resulted in their eventual use of technology as a tool to explore scientific ideas. Scaffolding was used in structuring the curriculum for changing the students’ use of technology as a novelty, to a tool capable of mediating higher learning. Three instructional phases: teacher directed, teacher/student directed, and student directed were effective in providing students with the necessary knowledge and skills to use technologies as tools.
Findings of the study indicate that the middle school students were able to use the technologies provided to improve the quality of their scientific investigations. The technologies enhanced students’ learning of science concepts by providing them opportunities to collect high quality data efficiently and easily. The findings may be perceived as evidence that technology can effectively be infused in the context of a middle school science classroom (Reid-Griffin, 2003).

Wetzel (2002) designed a study to determine the effects of an implementation plan on five middle school science teachers as they implemented and integrated both computer and calculator probeware technologies into their curricula. The framework for the study was the ST³AIRS Model, which consists of eight steps developed to overcome contextual barriers to technology integration: staff development, time, trainers, transition, access, involvement, recognition, and support. Findings of the study indicated that 80% of the participants overcame contextual barriers to pedagogical and curricular transformation, with a foundation for sustainability. The teachers had a shift in their teaching strategies and techniques, which included a student-centered approach when using technology, which was a pedagogical shift for the teachers. As teachers’ used the technologies and found them appropriate for middle school science, their views and beliefs regarding teaching and learning with technology shifted.

Grable and Curto (2001) reviewed the literature from 1990 to 1999, examining the use of computer-related technologies in middle school mathematics and science settings. Their investigation began with the structure of the middle school as the environment for technologies, the benefits of varying technologies, student issues surrounding the technologies, and the professional development issues surrounding teachers’ implementation of technology in the classroom. They found several types of technology used in science and math classrooms:
CD-ROMs for computer-aided instruction, hypermedia-assisted instruction as exemplified by the Web, microcomputer-based laboratories, and calculator-based laboratories. These technologies can be combined with principles of best practice to support a learning environment that integrates active learner involvement, critical thinking, and inquiry.

They further reported these technologies can serve the needs of many types of learners and can be an asset for the teacher willing to approach students as a facilitator. The use of technology tools can promote inquiry-based activities by allowing collection of large numbers of data points, short time intervals, and quick graphing. Teachers’ adoption of the technology tools may depend on issues with professional development, technical support, administrative support, subject matter preparations, student behavior, and management (Grable & Curto, 2001).

The computer can play a vital role in making science and mathematics real, dynamic, and engaging for students. The Apple Education Research (Apple Computer, Inc., 1995) on middle school science and mathematics reports computer tools in science help students understand and master high-level science concepts, working through a progression of conceptual levels. Students who used computers to create computational models of scientific processes dealt with more complex problems than those without modeling software. Technology provides hands-on experiences for students and allows them to interact with environments otherwise unavailable to them.

**Educational Technology**

**Technology Integration**

Throughout the 1970s and 1980s, technical innovation brought increasingly diverse and more powerful technological tools into schools. The pace of both technological development and the introduction of new technologies into educational settings have dramatically accelerated
during the past decade. These developments are making it possible for technologies to be
designed and deployed to produce powerful and linked technologies that can substantially
address some of the core problems of education (Honey et al., 1999).

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.

Integration is about using technology for learning. It is not substituting 30 minutes of
reading for 30 minutes of computer skills. Integration is not providing software applications
without a purpose (Dockstader, 1999). To integrate technology into education implies that
schooling will change, and as a result, it will improve.

“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). Tomei designed a checklist intended to assist educators in recognizing
strengths and weaknesses in their technology-based programs at their institutions. The 20-item
checklist includes questions categorized as use of technology, the necessary infrastructures, and a
viable instructional strategy. Using the checklist he sampled public and private schools to
validate the existence and impact of the technology façade. Most schools sampled merited a ‘C’
rating and several schools received ‘F’ rating.

Tomei further noted that few schools provided any incentives for teachers who went the
extra mile to prepare technology-based materials for their classroom. Contributing to the overall
poor showing was lesson planning and learning objectives, which demonstrates the need for school administrators to begin working with their teachers regarding curriculum redesign to integrate technology into classroom instruction (Tomei, 1999).

Integration is not putting computers in the classroom without teacher training. Throughout the literature, the recurring solution to integration of technology in the classroom is teacher education (Abdal-Haq, 1996; Grant, 2001; Mills & Tincher, 2003). Teachers require education in the use of technology as an instructional as well as a professional tool. 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).

Students must use the 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 (ISTE, 2000a). A technology-rich environment offers students the opportunity to become active participants in the learning process.

One strategy that naturally integrates technology in a number of ways is problem-based learning. Problem-based learning is learning organized around the investigation and resolution of an authentic problem. Technology is critical to such problem solving as a tool for locating and organizing information, a means of delivering a problem, and a means for presenting a solution. Students work toward technology standards by using problem-based learning in content area classes and technology classes. As teachers work toward encouraging students to become critical
thinkers, problem solvers, collaborative colleagues, and technology-literate citizens, they can use problem-based learning and technology as two means toward that end (Sage, 2000).

**Model Classroom**

Wetzel and Zambo (1996) described a model classroom as one that is using technology in ways that support the curriculum standards identified by professional societies that call for problem solving, communication, reasoning, and establishing connections among major curriculum areas. Kent State University designed a place for K-12 classes to work with the latest technology (Tiene & Luft, 2001). The classroom contains 12 computers that are networked and have Internet access, a scanner, a printer, videoconferencing cameras connected to several computers, digital still-frame cameras, camcorders, and a VCR. At the teacher’s station, there is a computer, a VCR, and a Video Document camera, all of which are connected to a video projector pointed at a screen that pulls down in the front of the class. The classroom is designed for researchers to observe and record how students work in a technology-rich classroom environment. Over a 10-week period, sixth, seventh, and eighth graders and 11 teachers were sent to use the classroom (Tiene & Luft, 2001).

Teachers reported on the following aspects of the educational experience: (1) development of skills with technology; (2) changes in classroom dynamics; (3) modification of teaching style; (4) satisfaction with the experience; and (5) achievement gains. Teachers and students were ill prepared at first to work with the technology, but by the end of the 10 weeks both made significant gains in their ability to work proficiently with the hardware and software. Individual pupils and teams of students were able to progress at their own pace, rather than working in unison on the same materials at a pace set by the teacher. Deadlines still existed, so students needed to plan their time wisely as they worked independently. Teachers tried to teach in more
constructivist ways, which demanded greater flexibility and creativity in the way they worked with different students (Tiene & Luft, 2001).

In a constructivist classroom, students are more actively involved than in a traditional classroom. In the constructivist classroom students are sharing ideas, asking questions, discussing concepts, and revising their ideas and misconceptions to make learning more meaningful (Sprague & Dede, 1999). The constructivist-learning model emphasizes the creation of active learning environments—environments that permit critical thinking, discovery, and collaboration. Evidence suggests that success is not solely the result of effective technologies; rather, success may be partly dependent on teachers using a constructivist-learning model (Howard, McGee, Schwartz, & Purcell, 2000).

A computer science teacher, Brenda Wimberly King, at New Iberia High School in Louisiana realized she had to organize her instruction and utilize computer equipment in her classroom. She established “seven discovery learning zones” where students work in small groups, and rotate among the zones every 20 days, to have a chance to work with the full spectrum of technology available. The learning zones feature topics such as artificial intelligence, web searching, programming, and robotics. Students create their own home page, assemble and operate robots, create their own videos, and experiment with transistors. The teacher is available to help students, but they usually solve their problems before she can get there (Milone, 1998).

**Relationship Between Educational Technology and Learning**

Technology and instruction should work together to make a successful program for all students (Dockstader, 1999). Educational technology has been found to have positive effects on student attitudes toward learning and on student self-concept. Students felt more successful in
school, were more motivated to learn and had increased self-confidence and self-esteem when using computer-based instruction (Sivin-Kachala & Bialo, 2000).

Teachers and administrators are recognizing that computer skills should not be taught in isolation, and that separate computer classes do not really help students learn to apply computer skills in meaningful ways. Moving from isolated skills instruction to an integrated approach is an important step that takes a great deal of planning and effort (Eisenberg & Johnson, 1996). All learners should be able to recognize what they need to accomplish, determine whether a computer will help them to do so, and then be able to use the computer as part of the process of accomplishing their task. Students need to be able to use computers flexibly, creatively, and purposefully.

Independent researchers commissioned by CDW-Government, Inc. conducted phone surveys with 606 public and private school teachers, including equal numbers from elementary, middle, and high school (Rother, 2003). Overall, respondents voiced clear benefits of technology’s evolving role in teaching, in communicating with parents, and in classroom administration. Major benefits fell into three categories: benefits in the classroom, benefits outside class, and benefits to teachers.

A majority (86%) of respondents said in-class computers improve academic performance, while 74% said computers increase student attention in class. Surprisingly, 65% of the teachers said that computers could be more effective than teachers in conveying certain types of educational materials. Asked about suitability of computers in class, 54% of elementary teachers, 63% of middle school teachers, and 68% of high school teachers voiced strong approval (Rother, 2003).
A study by Page (2002) compared the attainments of elementary students in technology-enriched classrooms and students in traditional classrooms in terms of student achievement, self-esteem, and classroom interaction. Classes from five Louisiana elementary schools were randomly assigned to either treatment or control groups. Treatment classrooms included a variety of technology hardware and software, while control classrooms did not. The subjects were 211 students of low socioeconomic status and various backgrounds, races, and ability levels. Findings showed statistically significant differences, favoring the treatment group, in mathematics achievement, composite self-esteem, school self-esteem, and general self-esteem. In addition, interaction analyses during the school year found a significant difference between type of classroom and type of verbal interactions; with treatment groups being student-centered and control groups being teacher-centered.

Hopson, Simms, and Knezek (2002) examined the effect of a technology-enriched classroom on student development of higher-order thinking skills and student attitudes toward computers. A sample of 80 sixth-grade and 86 fifth-grade students were tested using the Ross Test of Higher Cognitive Processes to judge the effectiveness of each group’s curriculum in its ability to teach the higher-order thinking skills of analysis, synthesis and evaluation. The Computer Attitude Questionnaire was utilized to determine student attitudes toward the computer. This research has shown that a class enriched with technology proves to have a minimal, yet positive effect upon student acquisition of higher-order thinking skills.

Eight teachers of four subjects at one high school participated in a study designed to assess the effects of computer integration on students in terms of academic achievement and attitudes toward academic subjects and computers. Student achievement was assessed by teacher-made tests. Attitude was assessed as part of a student survey questionnaire. It was found
that there was no significant effect of computer integration on achievement, and although positive attitude toward computers was high both before and after the integration period, there was no significant change in student attitude toward computers after the computer integration. However, students did perceive using computers as having a positive effect on their learning (Liu, Macmillan, & Timmons, 1998).

Kulik (2003) summarized findings from eight meta-analyses covering 335 studies published before 1990 and 61 controlled studies that were published after 1990. Findings of effectiveness of instructional technology for student learning show:

1. Dramatic changes in:
   - computer to student ratio, from 125 students to every computer in 1984 to 6.3:1 in 1998.
   - access to the Internet in schools; 98% of schools had access to the Internet in 2000, compared with 3% in 1989.
   - ratio of multimedia computers to students, which improved to 9.8:1 in 1999.
   - ratio of students to Internet connected computers, improved to 13.6:1 in 1999.

2. In the case of applications, teachers are better prepared than they were in the 1980s to integrate technology with classroom instruction.

3. The digital divide remains wide. Schools with minority and less affluent students have fewer computers and less Internet access than do other schools.

4. A survey of teacher use of computers shows that students today most frequently use computers as tools rather than as tutors, and the most frequent teacher objectives for student use are to find out about ideas and information in contrast to a decade ago when the most frequent objectives were for basic skills training and computer literacy.

In 2002, North Central Regional Educational Laboratory [NCREL] commissioned a meta-analysis by Waxman et al. to study the effects of teaching and learning with technology on student outcomes. To estimate the effects of teaching and learning with technology on students’ cognitive, affective, and behavioral outcomes of learning, effect sizes were calculated using
statistical data from 20 studies that contained a combined sample of approximately 4,400 students. Evidence for the use of effective pedagogy was not very prevalent in the studies reviewed. In 85% of the studies, there was no evidence that instructional conversations (extended dialogue between teachers and students) occurred in the classroom. In more than half of the studies, the use of joint productive activities, language and literacy activities, contextualization/making meaning, and challenging activities was not described.

The cognitive outcomes used in the 20 studies varied widely. The most common cognitive outcomes were a researcher-based test (30%), followed by standardized tests (20%), and a creativity test (20%). About 10% of the studies used teacher-made tests, and 10% used school-level tests. About 85% of the affective outcomes were student attitudes towards computers, and 15% were students’ motivation. All of the behavioral outcomes examined in the studies focused on the outcome of student attendance (Waxman et al., 2002).

Results from this meta-analysis are both discouraging and encouraging. The discouraging aspect is that the overall effects are quite modest, although similar to other meta-analyses, and the quality of the research are similar to previous concerns that have been raised by other researchers. The aspect that is encouraging and that may stimulate future research lies in a comprehensive list of variables included in the meta-analysis. This conceptualization suggests that teaching and technology processes either may directly impact student outcomes or may interact with technology features and indirectly impact outcomes (Waxman et al., 2002).

Roschelle, Pea, Hoadley, Gordin, & Means (2000) conducted an extensive review of literature examining effective educational applications of computer-based technology. Over 80 sources are cited and evidence includes teacher surveys, standardized test performance, student self-reports, and meta-analytic reviews. The subjects range from pre-kindergarten to 12th grade.
students, and vary on demographic characteristics. Findings indicate that computer-based technologies are potentially effective instructional tools that provide support along a number of dimensions that characterize effective educational environments: (1) active engagement, (2) participation in groups, (3) frequent interaction and feedback, and (4) connections to real-world contexts. The research indicates that the use of technology as an effective learning tool is more likely to take place when embedded in a broader education reform movement that includes improvements in teacher training, curriculum, student assessment, and a school’s capacity for change.

Various research groups have conducted studies and reviewed the literature on technology and learning and concluded that it has great potential to enhance student achievement. Kirby and Schmidt (1995) report a general agreement exists that higher-order or critical-thinking skills are required in a computer-driven society and that educators must respond to how these skills can best be taught to students. A teacher’s challenge is to create a classroom that supports, rather than hinders, students’ inherent ability to learn.

**Technology Use in the Classroom**

Because the teachers are the key to their students’ success in the classroom, teacher requirements for mastering new methods, knowledge, and techniques with regard to technology deserve particular attention (Goddard, 2002). Teachers must first educate themselves and integrate technology into their personal teaching method before that technology can become an effective tool for educating students. In studies done for the Apple Classroom of Tomorrow [ACOT] project (1990), researchers, Dwyer, Ringstaff, and Sandholtz, identified five stages of instructional evolution for technology integration (see Table 2).
### Table 2

#### Instructional Evolutions

<table>
<thead>
<tr>
<th>Stage</th>
<th>Technology Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1 – Entry</td>
<td>Teachers are concerned with time and efforts required and wonder if computers are effective learning tools. Teachers experience both trepidation and excitement as they learn to master the new tools.</td>
</tr>
<tr>
<td>Stage 2 – Adoption</td>
<td>Teachers begin to blend technology into classroom practices, but make no changes in practice. Teachers use drill-and-practice or word-processing software.</td>
</tr>
<tr>
<td>Stage 3 – Adaptation</td>
<td>New technology becomes thoroughly integrated into traditional classroom practices. Word processors, databases, graphic programs, presentation tools, and content-specific software are used. Teachers see that students learn more, produce better work, and are more engaged in learning.</td>
</tr>
<tr>
<td>Stage 4 – Appropriation</td>
<td>Teachers understand technology and use it effortlessly in their own work and in their classroom. Teachers can’t image how they functioned without it.</td>
</tr>
<tr>
<td>Stage 5 – Invention</td>
<td>Teachers are ready to experiment with new instructional patterns and ways of relating to students and other teachers. They use interdisciplinary project-based instruction, team teaching, and individually paced instruction become common. Students have high levels of skill with technology, an ability to learn on their own, problem solving, and movement toward more collaborative work patterns.</td>
</tr>
</tbody>
</table>

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).

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.

Many teachers (72%) said that computer technology has made their job easier. Computers have begun to ease teachers’ administrative work, with 25% of teachers citing improved efficiency in attendance tracking, lesson planning, and other routine tasks. Technology has altered how educators run their classrooms, with 88% of teachers reporting that computers have changed how they teach (Rother, 2003).

Ryba and Brown (2000) conducted a study of proficient technology teachers to see how they integrate computers into the curriculum. Information gained from the case studies help to identify some key ideas on how to create better conditions for learning.

- Socially interactive and reflective learning environments were identified as a key idea for better learning conditions. This was done through the use of problem solving models and direct teaching of metacognitive skills concerned with exploration, analysis, planning, and self-evaluation.

- The second key idea was communities of practice. Teachers described their classes as communities of learners that showed greater competence, motivation, and participation than traditional approaches to learning.

- The third key idea identified was collective zone of proximal development. Teachers see their students as an intellectual collective where there is the potential for all
students to advance in their knowledge and skills. Students learn from interacting with one another.

- The fourth idea is reflective professional practice. The teachers had a strong commitment to learner-centered approaches in which students took responsibility for self-regulation of their learning and behavior.

In order to investigate the degree to which teachers are using computers in the classroom, Barron, Kemker, Harmes, & Kalaydjian (2003) designed and administered a survey to teachers in a large urban school. The survey targeted the areas of teacher attitudes toward computer use, integration of computers into instruction, types of software used, and teacher confidence and comfort with computer use. In the context of the National Educational Technology Standards for Teachers [NETS-T], the sections of primary interest for this study were those focusing on the integration of computers into instruction and teacher attitudes toward computer use.

When comparing elementary, middle, and high school teachers, Barron et al. (2003) found that elementary school teachers were integrating computers into the classroom more frequently than middle and high school teachers. When integration of computers in the classroom was compared by subject area, among middle and high school English, math, science and social studies teachers, it appeared that science teachers were using technology more frequently. Most significantly, the science teachers used technology for independent learning, as communication tools, as a research tool for students, as a productivity tool and as a classroom presentation tool more often then for other reasons. It was found that instructional software was used more often at the elementary level and application software more often at the middle and high school levels. The specific application software used most frequently by all teachers was word processing software and web browser software. In summary, this study indicates that technology is being integrated in schools at various levels (Barron et al., 2003).
Becker, Ravitz, and Wong (1999), at the University of California, Irvine completed The Teaching, Learning, and Computing (TLC) study and established eight reports related to technology, constructivist practice, learning, and teaching. The survey database includes information from 1,150 schools including completed questionnaires from approximately 4,100 teachers, 800 technology coordinators, and 850 principals. From the reports, these findings are pertinent to how teachers use technology:

1. While 30% of English teachers and 43% of elementary teachers assign computer work frequently (20+ times a year), only 17% of science teachers and 11% of math teachers do so.

2. At the middle school level, 30% of students’ experiencing the use of computers takes place in English classes.

3. Regular use of computers with students is highly dependent on access to computers. Access to several computers in a classroom proves to be a more suitable setting for a great deal of school-based computer uses than does an even greater number in a computer lab.

4. Secondary teachers who have at least one computer in their classroom for every four students are more than three times as likely to have students use computers on a regular bases (62% are frequent users compared to 18% of those who have no computers in their classroom and use labs for students’ computer work).

5. When reporting frequent student use (10+) of particular types of software: 50% of all teachers (grades 4-12) have students use word processing software; CD-ROM reference software is used by 36% of all teachers; 30% of all teachers have students use the World Wide Web; only 5% of science teachers had students use simulation or modeling software; only 7% of vocational education teachers report frequent use of spreadsheet and database programs; and of the English teachers 4% have students use presentation software.

6. Math teachers and foreign language teachers are among the least likely to be making computers a regular part of instructional practice.

7. Software programs teachers most often name as most valuable for student use are general office applications and web browsers.

8. Elementary and middle grades teachers report Accelerated Reader and Hyperstudio to be most valuable for students, while math teachers report Geometer’s Sketchpad, and Vocational Education reports the use of AutoCAD as the most valuable.
9. Teacher objectives for students’ computer use vary by subject:

- Social studies and teachers of mixed academic subjects are interested in students finding out about ideas.

- English and elementary teachers are more interested in students expressing themselves in writing.

- Math, computer, and business teachers reported more traditional objectives of mastering skills and improving computer skills.

10. Teachers more likely to have students do computer work on their own time (before or after class) were more likely to select four main objectives for student computer use:

- Presenting information to an audience,

- Improving their writing,

- Communicating with other people,

- Finding out about ideas and information.

11. Teacher computer skill level was associated with more frequent assignment of computer work to students, but not as strong as the teachers’ own professional use of computers.

12. The more computer-skilled the teachers, the more likely their primary objective for students use had to do with students presenting material, communicating, and analyzing information.

13. Teachers with lower levels of computer expertise were only interested in student use for remediating skills.

Berg, Benz, Lasley, & Raisch (1998) completed a descriptive study that identifies and describes how exemplary technology using teachers are using technology in their elementary classroom. In the area that became grouped as “instructional design” coordinators stress such things as the importance of collaboration, integration of subject areas, individualized and interactive learning, and communication with parents. Exemplary teachers verified this fact citing motivating 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. Less frequent in use, despite belief in importance were Internet applications, problem solving, basic-skills practice, and student use of multimedia authoring programs. The teachers in this study have invested a great deal of time in learning technology skills and most frequently learn things on their own.

Findings from a nationwide survey of teachers experienced at integrating computers into their teaching reveals a compelling story of motivated and professional teachers who have learned to use computers in their classrooms in multiple ways. The results reveal teachers who have 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 teach differently and more effectively than they did in the past (Hadley & Sheingold, 1993).

Some teachers report significant advantages in using the Internet to electronically extend classrooms and schools to parents and the community. Middle schools are especially likely to use technology to communicate with parents. More than three-fourths (77%) of schools have websites to share information about classes, homework, and grades. Virtually all the teachers (96%) have email access at school and 64% reported communicating electronically with parents (Rother, 2003).

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 demonstrate 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).

**Teachers’ Beliefs**

How teachers view their roles 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).

Teachers’ resistance to change is primarily due to their 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).
In the first years of the ACOT study researchers noted few changes to classroom instruction. Over time these classrooms became hybrids of traditional and constructivist teaching with teachers collaborating in the learning process with students and each other. The five-phase model (see Table 2) is based on the collected data marking these changes. Underlying the model is the view that such changes will occur only if there is a simultaneous change in teachers’ beliefs about their practice. Instructional evolution is not simply a matter of abandoning beliefs but one of gradually replacing them with more relevant ones shaped by experiences in an altered context (Dwyer et al., 1990).

Ertmer et al. (1999) examined seven primary teachers’ beliefs about the role of technology in the elementary classroom. Using interviews they asked teachers to describe the role technology should play in the classroom, their goals for technology use, and examples of successful computer use. They found that teachers use technology as a supplement. It is used as an incentive for students to finish work or as a reward for the completion of assigned work. Technology was considered to be additional or supplementary to the existing curriculum. These teachers also made reference to how technology supported their curriculum by reinforcing skills or providing students with extra practice. Teachers in this study made few references to using technology to go beyond current curricula. There was no “emerging” use of technology, using technology to take the curriculum in new directions.

Ertmer et al. (1999) further reports what teachers cited as five main reasons they used computers in their classroom: (1) how exciting and motivating computers were for their students; (2) how students needed to use technology to be prepared for the future; (3) how technology made their lessons more interesting to students; (4) how technology enabled them to reach students with learning or attention problems; and (5) their own enjoyment in using technology.
and becoming more competent. Teachers’ beliefs about classroom practice appeared to shape their goals for technology use as well as the weight they assigned barriers.

Teachers’ beliefs about curriculum and instruction may play an important role in the implementation of reforms. In a 1999 study, Czerniak, Lumpe, Haney, and Beck sought to examine the influence of K-12 teachers’ beliefs on their intent to use educational technology in their classrooms. Using the Theory of Planned Behavior they examined the influences of K-12 teachers’ attitudes, subjective norm (social support), and perceived behavioral control (external influences). Teachers in this study share the belief that educational technology enhances student learning and that the integration of technology into their teaching is both desirable and needed. However, they do not perceive that sufficient support structures are in place to enable them to achieve the outlined technology education standards.

Influencing teachers’ beliefs about integrating technology can be a possible answer to implementing fundamental technological changes in the classroom (Sugar, 2002). Sugar suggests the adoption of human-centered design principles and their corresponding philosophy as a plausible solution to affecting teachers’ beliefs on the use of technology and can be a vehicle to changing their existing beliefs. The term, human-centered is synonymous with terms such as user-centered and learner-centered. With this newly adopted human-centered attitude, teachers will more readily integrate old and new technologies into their teaching practices.

If teachers are not convinced that student outcomes will improve through the use of technology, they have less incentive to incorporate it. The study by Czerniak et al. (1999) suggests support structures are needed in five areas: (1) the teachers’ subjective norm (colleagues, parents, community members, university faculty, and business/industry leaders), (2) resources (funding, enough equipment, more software, projection devices, access to the
Internet, and quality software), (3) classroom structures that support use of technology (proper electrical connections, moveable tables, proper fuses/circuit breakers, and space), (4) staff development opportunities on technology, and (5) time to learn, plan, and implement educational technology. Based on the results of their study Ertmer et al. (1999) recommend using the following strategies at each level of integration: (1) incorporate a dual focus on technological and pedagogical issues during training efforts; (2) foster a broader vision of technology integration; (3) provide instructional resources during the change process; and (4) provide opportunities for reflection, collaboration, and discussions with peers. Educators should examine teachers’ beliefs before planning classes, workshops, or seminars.

**Context Factors Affecting Teachers’ Use of Technology**

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, 1999; 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 do not believe that many of the enabling factors will actually occur in their school.

One rural district implemented a mentoring relationship among elementary teachers in a rural school district and graduate students in instructional technology at a university in the Midwest to overcome barriers to technology integration (Franklin et al., 2001). Mentors modeled integration of the technology in the classroom; provided support by showing how to repair machines, load software, navigate printing problems, and locate necessary hardware; allowed “just in time” learning; provided lesson design opportunities; and helped develop strategies for overcoming the barriers of vision, time, access, and assessment. Chuang, Thompson and Schmidt (2003) provided a review of literature on mentoring models used in higher education and K-12 schools. Despite the variety of technology mentoring models, they included common elements like providing visions for technology use, individualizing technology support, breaking down hierarchical structure, establishing learning communities, and providing mutual benefits for mentors and mentees.

For teachers to use technology in the classroom, they need certain skills in order to implement their plans. A few hardy individuals will lead the way on their own, but most need instruction and encouragement to get started, and a media facility and support staff to keep them going. Technology leaders must realize that support is multifaceted and comprehensive that
requires careful planning. It is not just technical support, such as routine maintenance, but also instructional support, including individualized training, professional development activities, and professional development content that focuses on instruction and integration (Ronnkvist et al., 2000).

Yildirim (2000) conducted a study to examine the changes in preservice and inservice teachers’ attitudes toward computers following their participation in an educational computing class, and explored the factors that contributed to computer use. 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. In most education institutions, computer-specific courses are offered as an initial attempt to prepare teachers in the use of computer technology. Despite training teachers are still hesitant and not ready to embrace technology. Research finds that a negative attitude toward computers influences the learning process. After his study Yildirim suggests one way to encourage teachers to use computers in the classroom is to increase their level of competency.

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. And 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. Teachers with more training are searching the Internet for information and resources to use in the classroom (Doherty & Orlofsky, 2001).

The Regional Educational Assistance [RETA] program provides professional development for teachers and administrators to improve teaching performance, educational leadership, and student learning through increased understanding and use of learning technologies (Gonzales, Pickett, Hupert & Martin, 2002). Using case study design researchers report findings that suggest that, as a result of peer-directed, constructivist-based professional development workshops, teachers: (1) increased their use of technology in the classroom; (2) increased their use of certain constructivist practices in the classroom; (3) increased their collaboration with other teachers; and (4) assumed more leadership positions. Teachers’ uses of computers are now geared to gaining computer competence and less toward computer skills. This extends their approach to a more constructivist one where the computers are tools used to improve students’ communicating, thinking, producing, and presenting their ideas. With the confidence, motivation, and collaboration fostered by participation in the workshops, teachers are willing to pursue and serve in positions of leadership at the school, district, community, and state levels (Gonzales et al., 2002).

Jaber and Moore (1999) conducted a study with 1017 teachers, elementary (47%), middle (22%), and high (31%) school teachers from two county school systems in rural Virginia and West Virginia school systems. The results obtained in the study indicate that access influences instructional activity and frequency of use. Given sufficient access to computers, professionally active teachers will use them in exemplary ways, as tools to achieve greater outcomes of students communicating, thinking, producing, and presenting their ideas (Becker & Riel, 2000).
Using information collected from surveys of third through twelfth grade computer-using teachers, Becker (1994) found patterns in the teachers’ personal characteristics, in the environments in which they teach, and in their teaching habits. When surveyed about their personal backgrounds, Becker found that these exemplary computer-using teachers, more than other teachers, spent a great deal of their personal time working on computers. These teachers had more training with using computers, higher levels of education, and more experience teaching their current subject.

Truly integrating technology into teaching and learning is a slow, time-consuming process that requires substantial levels of support and encouragement for educators (Byrom, 1998). Teachers must have ample time to learn about new technologies and they need time to use technology with their students (Czerniak et al., 1999). Teachers need to be surrounded by other computer-using teachers in their school in order to benefit from collegial sharing of ideas, resources, and teaching strategies. An optimal school environment should provide teachers with opportunities to work and learn together and promote sharing of experiences, opinions, and ideas (Mouza, 2002).

Results from a study by Vannatta and Fordham (2004) indicate that the factor combination of amount of technology training, time spent beyond contractual workweek, and openness to change predicted classroom technology use. Meaningful integration of computers and instruction is a difficult task, one that requires contact, collaboration, and support from professional peers, the school organization, and the educational community as a whole (Becker & Riel, 2000).

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).

Qualitative Research Design

The basic methodologies of educational research are quantitative research and qualitative
research. Quantitative research uses objective measurement and numerical analysis of data to try
to explain the causes of changes in social phenomena (Ary, Jacobs, & Razavieh, 1996).
Qualitative research is an inquiry process in a natural setting where the researcher is an
instrument of data collection that explores a social or human problem (Creswell, 1998).
Quantitative research begins with hypotheses that will be supported or not supported in the data.
Qualitative research does not usually begin with hypotheses, although the research may generate
them as events occur (Ary et al., 1996).

Qualitative study lends itself to thick narrative description. It takes place on site, in the
group’s natural environment, and attempts to be nonmanipulative of the groups’ behaviors. The
purpose is to aim for objectivity, while taking into account the views of the participants. An
initial phase of design is to consider whether a qualitative study is suitable for the study of a
problem, and also to frame the study within the philosophical and theoretical perspectives
(Creswell, 1998). Creswell identifies five assumptions that guide design and are central to all
qualitative studies: the multiple nature of reality, the close relationship of the researcher to that
being researched, the value-laden aspect of inquiry, the personal approach to writing the
narrative, and the emerging inductive methodology of the process of research.

In qualitative studies, the researcher is the instrument. Whether the researcher’s presence
is sustained and intensive, as in long-term ethnographies, or whether relatively brief but personal,
as in in-depth interview studies, the researcher enters into the lives of the participants (Marshall
& Rossman, 1999). The researcher’s role entails varying degrees of participantness – from full
participant to complete observer, and all possible mixes along the continuum. Because the
researcher is the instrument a qualitative report must include information about the researcher
(Patton, 1990).

The qualities that make a successful qualitative researcher are revealed through
sensitivity to the ethical issues. The competent researcher demonstrates awareness of ethical
issues in qualitative research and shows that the research is both feasible and ethical (Marshall &
Rossman, 1999). Suggestions that address ethical issues include: recruitment of respondents via
informed consent; conduct fieldwork so as to avoid harm to others; protection of confidentiality
in reports; emphasize reciprocity with the researched; make reports just, fair, and honest; and be
sensitive to the language and meanings of the culture being studied (Miles & Huberman, 1994).

A credible qualitative study will address three credibility issues: (1) techniques and
methods used to ensure the integrity, validity, and accuracy of the findings; (2) what the
researcher brings to the study in terms of qualifications, experience, and perspective; and (3) the
paradigm orientation and assumptions that undergird the study (Patton, 1990). “The qualitative
researcher has an obligation to be methodical in reporting sufficient details of data collection and
the processes of analysis to permit others to judge the quality of the resulting product” (Patton,
Qualitative analysis can be defined as three concurrent flows of activity: data reduction, data display, and conclusion drawing (Miles & Huberman, 1994). Data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions. Data display is an organized, compressed assembly of information that permits conclusion drawing and action. Conclusion drawing is deciding what things mean, noting regularities, patterns, explanations, possible configurations, causal flows, and propositions. Conclusions are verified as analysis proceeds. Meanings emerging from the data have to be tested for plausibility, sturdiness, and confirmability – that is validity (Miles & Huberman, 1994).

Specific genres of qualitative research include biography, phenomenology, grounded theory, ethnography, and case studies. The focus of a biography is on the life of an individual, and the focus of a phenomenology is on understanding a concept or phenomenon. In grounded theory, one develops a theory, whereas a portrait is drawn of a cultural group or people in ethnography. In a case study, a specific case is examined (Creswell, 1998).

The focus of ethnography is a portrait of a cultural group. This method was developed by anthropologists (like Margaret Mead) as a way to study and describe human cultures. “The term ethnography is used to refer to both the work of studying a culture and also the end product of the research” (Ary et al., 1996, p 487). An ethnographic design is chosen when one wants to study the behaviors of a culture-sharing group, such as exemplary technology teachers. This design requires considerable time observing and interviewing in the schools. The ethnographic method involves observation and note taking. There is no attempt at summarizing, generalizing, or hypothesizing. The notes capture as factual a description of the drama as possible to permit interpretations and to infer cultural meaning. A coding procedure is used for this. The researcher
watches and listens carefully without being noticed (Creswell, 1998). Reporting the ethnography is generally in narrative form and contains thick descriptions of setting and context (Ary et al., 1996). The general structure of the ethnography study begins with the introduction of the problem or questions to be answered. Research procedures include data collection, analysis, and outcomes (Creswell, 1998).

A case study is chosen to study a case with clear boundaries, such as a school district or a teacher. The researcher needs to have a wide array of information about the case to provide an in-depth picture of it (Creswell, 1998). The study attempts to describe the subject’s entire range of behaviors and the relationship of these behaviors to the subject’s history and environment. The investigator tries to discover all the variables that are important in the history or development of the subject. The emphasis is on understanding why the individual does what he or she does and how behavior changes as the individual responds to the environment. The investigator gathers data about the subject’s present state, past experiences, environment, and how these factors relate to one another. The research attempts to determine why an individual behaves as he or she does and not merely to record behavior. The intensive probing of this technique may lead to the discovery of previously unsuspected relationships. Since the extent to which case studies can produce valid generalizations is limited, their major usefulness is not as tools for testing hypotheses, but rather in the production of hypotheses, which can then be tested through more rigorous investigation (Ary et al., 1996).

Content analysis is a research method applied to written or visual materials for the purpose of identifying specified characteristics of the material. An advantage of content analysis is that it is unobtrusive (Ary et al., 1996). In this study content analysis was applied to lesson plans.
CHAPTER 3

METHODOLOGY

The purpose of this study was to explore beliefs, context factors, and practices of exemplary teachers that lead to a technology-enriched curriculum. My ethnographic case study focused on three middle school teachers in a Louisiana school district and employed several methods of data collection: three rounds of observations, structured interviews, and content analysis. Immersion in the data to identify patterns and themes guided data analysis. Data obtained in the interviews were organized into categories of beliefs and context factors. Practices were divided into subsets using preset labels from the observation tool. This ethnographic case study of three teachers produced knowledge relevant to the understanding of technology integration in general.

The purpose of this chapter is to describe the design and methods of my study. Major topics addressed in this section include: qualitative approach, research tools, guiding questions, the researcher’s role, data management, data analysis techniques, trustworthiness features, and ethical and political consideration.

Rationale for Qualitative Approach

Since I focused my study on exemplary technology teachers’ beliefs, context factors, and practices, I felt the ethnographic case study was best suited for my 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, have 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 I was able to explore 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 characteristic of this study is 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 et al., 1996). With prolonged observations in their natural settings I was able to focus 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 and recorded how each teacher functioned in her natural environment integrating technology into her lessons. The 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.

Focused observations of the use of technology can bring insight into teachers’ practices. Observations alone will not signify why the teacher has chosen an instructional method; therefore, to better understand the teacher’s style observations were followed by one-on-one interviews with the teachers. With the ethnographic case study approach I gathered a wealth of data for individual case analysis and comparisons and contrasts across cases.

With extended immersion in the field, typical of qualitative research, there is a concern about the validity and reliability of the researcher’s own interpretation of their set of participants (Silverman, 2000). Because issues of validity and reliability are an important part of any study it is important to identify some ways of dealing with results. 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 my 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).

To check for credibility of the data being gathered and to confirm developing themes, techniques of prolonged engagement and repeated observation were used. My years of experience as a technology consultant helped define my role as both direct observer and
participant observer in my study. With 10 years of teaching and training experience I have worked in a variety of schools training K-12 teachers in software and integration skills and modeling technology integration in their classrooms. Having first-hand knowledge of factors teachers see as barriers to technology integration helped me focus on important data while observing classroom activities.

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. My co-chair read the transcribed interviews, notes, and observations to corroborate my assertions.

The United States Department of Education (1998), through the American Institutes for Research, has obtained permission from copyright holders and other producers to reproduce questionnaires for evaluating the use of technology in schools and classrooms for research purposes. These surveys are readily available and accessible on the Department of Education website. However, it is difficult to obtain a detailed picture of computer use in schools from data collected on surveys. Since in any survey, the respondent knows that he or she is being studied, the information provided may not be valid. The respondent may wish to impress (by attributing a higher skill level) or please (by providing the kind of response they believe the researcher is looking for) the researcher. This is known as response error or bias. In my personal experience teachers have admitted being dishonest on surveys so they would not look bad. Since data was collected through prolonged observation and not survey, the results are not subject to response bias.
The chosen system of study enhanced the general knowledge of emerging technology trends. The information gathered from this study provides: (1) up-to-date information on what and how educational technology is used today; and (2) information which gives other educators an understanding of what beliefs and context factors influence teachers to integrate technology into their curriculum.

**Research Tools**

**Observation Instrument**

An observation instrument for technology integration (see Appendix A) was used in round two focused observations. According to Painter (2001) the process of developing an instrument or data collection protocol to use in evaluating technology integration forces the discussion of such questions as, “What observable behaviors will indicate that technology integration is successful in this setting?” (p. 22). This brings up complexities that appear to be uniquely problematic to the area of technology integration. She further states the classroom observation should provide information about the quality of technology integration into the lesson, not just its presence or absence or the extent of its use.

Investigators and staff from Arizona State University and Mike Timms of WestEd developed the Integration of Technology Observation Instrument as an evaluation component of the Arizona State University Preparing Tomorrow’s Teachers to use Technology (PT³) grant. To collect data, the observer checks off the presence of various attributes of technology integration observed during three-minute intervals. Altering the protocol from three-minute intervals to five-minute intervals worked better for my purposes and allowed more time for checking the boxes and making written notes. The check marks for the noted intervals are then tallied for an overall distribution of observed events. Because of its modular design, components of the instrument can
easily be added or removed to meet the needs of PK-12 school district classroom observation. This observation sheet structured with checklist and rating scales easily translated into a Microsoft Excel spreadsheet for analysis of percentage of the time each item was observed.

A good observation instrument must reflect a carefully thought out definition of technology integration. A large source of variation in observation data is differences in how observers interpret and record the same events. The primary technique for consistent observations (reliability) is providing explicit instructions to the observers. This is facilitated by basing observations on standards such as National Educational Technology Standards [NETS], which represent a general consensus for how effective technology use is demonstrated. The items in the Integration of Technology Observation Instrument are aligned with the National Educational Technology Standards for Teachers [NETS-T] and National Educational Technology Standards for Students [NETS-S] and are limited to observable behaviors only (ISTE, 2003).

The Integration of Technology Observation Instrument is intended to focus on the use of technology and is not intended to value one model of instruction over another. Time-linked data is analyzed for the percentage of time each variable is observed in the classroom. The activity record sheet is divided into several components: class organization, teacher role, teachers’ use of technology, students’ use of technology, and students’ level of technical skills.

Classroom organization indicates that the teacher uses grouping in flexible ways to take advantage of lesson goals and technology availability. There are many different settings in which instruction takes place: whole group, teams with three to five members, pairs, and individually. Classroom grouping and the arrangement of computers help us draw conclusions about efficient use of technology.
By observing the teachers’ role at timed intervals, evaluators are able to see the role the teacher plays in the classroom: directing, interactive direction, modeling, facilitating/coaching, or managing. This item provides descriptive data of how teachers use class time. It shows what percent of time the teachers allow students to work on their own with the technology.

A teacher should demonstrate a sound understanding of technology operations and concepts. A look at the teacher’s use of technology will help determine a teacher’s level of skill or stage of use in incorporating technology. Description of technology used by the teacher will help articulate how the teacher’s knowledge and use of technology helps in preparing for the use of and supporting technology in student learning. It will show whether the technology is integral or merely an add-on.

Technology should be used as a tool to learn with and should be related to the lesson objectives. The purpose of students’ use of technology is to engage them in authentic tasks. Data from observations will demonstrate the purpose, extent and nature of use of various productivity tools, subject specific learning tools, communications tools, and research tools.

The percent of time that students can operate without direct teacher assistance is an indication that the teacher has selected a technology at the appropriate level of difficulty and prepared students with skills and strategies to learn effectively using their own classroom resources. The teacher has trained student experts, has visual aids, or has taught the use of wizards or strategies to help students overcome technology difficulties. This is evidenced by the students’ ease of use of the technology.
Lesson Plan Rubric

The study teachers were required to develop technology rich lessons and exercises for their students. They each have a website and showcase technology rich lessons and student work. Using a lesson plan rubric a content analysis of lessons was completed to enrich the data.

Through the creation of an electronic resource center, ‘Making Connections,’ (2002) Louisiana teachers access “a one stop shop” for instructional materials that enhance teaching, learning, and technology opportunities in Louisiana’s K-12 schools. Lessons placed in the ‘Making Connections’ resource are evaluated using a comprehensive rubric. Teachers’ lessons printed from the district website were evaluated with the ‘Making Connections’ comprehensive rubric (see Appendix B).

The criteria listed on the rubric can be used to evaluate standards-based, technology-rich lesson plans. The same scoring used by the state was used to evaluate the study teacher’s lesson plans. Characteristics described in each cell of the column with heading “3 points” were target points for all lessons. Lesson plan elements listed for evaluation include: content area, objectives, opening activities, learning activities, student-centered instruction, collaboration, concluding activities, technology integration, state technology standards, assessment, lesson materials, modifications for special populations, extensions, resource variety, and ease of use. All lessons evaluated received a maximum score of 36.

Guiding Questions

The qualitative examination and quantitative analysis in this 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? In order to investigate the backgrounds and
beliefs of the three study teachers and context factors affecting them eight questions were asked in a one-on-one interview with each teacher.

The first question in the interview dealt with how they were chosen to participate in the grant. Training helps teachers achieve success and helps build teacher confidence that enable them to integrate technology into their classroom. Training time and type varies according to individuals, so training should be whatever satisfies a teacher’s need for learning. That learning should include what the teacher needs to learn to effectively use the computer as both a personal and instructional tool. Teachers must have substantial time if they are going to acquire and transfer to the classroom the knowledge and skills necessary to effectively and completely infuse technology into their curricular areas (Brand, 1997). The next three questions helped to evaluate the teachers’ technology skills.

A growing body of research has revealed that teachers have a central place in shaping the nature of computer use in the classroom. Wanting to know what beliefs about the role of technology helped in shaping these technology-rich classrooms two of the questions dealt with the teachers’ beliefs. In addition, studies concerning the use of computer-based technology for instruction conducted and reported in the last seven years indicate training and support is needed if teachers are going to successfully use computer-based technology in their instruction (Jaber & Moore, 1999). Wanting to investigate this further I asked a question to help determine the support these teachers receive at the school and district level.

Ertmer et al. (1999) identified lack of time as a barrier to the use of computers when their study examined teachers’ beliefs about the role of technology in the elementary classroom. Jaber and Moore (1999) reported advance planning as the greatest influence in the success of student learning activities. One complaint I have heard from many teachers I’ve worked with is that they
have no time to plan for technology. Interested in finding how these exemplary teachers have found the time for planning I asked one question dealing with preparation time.

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

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?

**Researcher’s Role**

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. 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. Observational evidence is often useful in providing information about the topic being studied (Yin, 2003).

Both direct observation and participant observation were employed at various times, depending on the activity. When the teacher was involved with direct instruction, I observed from a place in the classroom that afforded a clear view. When students were working
independently or in small groups, I circulated around the room, talking to students, observing what they were doing, answering some questions, and assisting with software commands. All three teachers encouraged my participation, and welcomed my help. During the first round of observations the teachers encouraged me 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. I was never introduced to the students, and strove to maintain a presence in each classroom that was as natural as possible. I 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 by me.

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. My role was that of interviewer: providing clear explanations of the questions, helping teachers feel at ease, and operating the audiotape for data collection.

**Data Management**

Fieldwork for this study generated a considerable amount of data. Field notes were stored by site and teacher and by round of fieldwork. These documents were typed into Microsoft Word software, saved in a rich text format, and imported into NVivo2.0, qualitative research software.

I personally transcribed the audiotapes from the one-on-one interviews verbatim into Microsoft Word software. Quotes were noted as such before importing into NVivo2.0 software. Repeated coding, comparisons and contrasts were used to organize, sort, and make subsets of the data for organized retrieval of information. I printed lesson plans, and other pertinent data from the Louisiana public school district website for evaluation.
Data Analysis

Data collection began with a grand tour descriptive observation (Spradley, 1980) with each teacher. In the first round of observations I 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 (see Appendix C), and constant comparison searching for patterns and themes.

An observation instrument was utilized for the focused second round of observations. 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 (see Appendix D). 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 I narrowed the scope 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, 1994) in NVivo2.0 software. 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, was used to develop tree nodes (thoughts and definitions about your 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. This software allows visual display of ideas, theories, and processes by modeling with a tool that supports layers of models as ideas develop. It was important to identify the evidence to support my 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,
that show the representation of the interconnected components that led each teacher to integrate technology.

I began cross-case analysis by creating a meta-matrix (see Appendix E), assembling data from each case, to verify cultural themes and pattern clarification. Using the variable-oriented analysis (Miles & Huberman, 1994) I once again used the variables specified in the central research question: beliefs, context factors, and practices. Looking across blocks of columns I was 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.

**Trustworthiness**

Reliability is one of two key criteria through which we can assess any research study. Reliability refers to the degree of consistency with which instances are assigned to the same category by different observers. The other key criterion is validity. The issue of validity is usually posed in terms of what constitutes a credible claim to truth (Silverman, 2000). Two common responses to validity are method and data triangulation and/or respondent validation.

Triangulation is the use of multiple sources of data, multiple observers, and multiple methods to enhance the probability that interpretations are credible (Miles & Huberman, 1994). Triangulation methods of observation, interview, and document analysis were used in this study to provide a complete understanding of the beliefs, context factors, and practices of exemplary technology teachers. In addition, each participant was afforded opportunities to read, correct, and make comments on written descriptions, assertions, and interconnected components. The participants made no changes.
To check for credibility of the data being gathered and to confirm developing themes, techniques of prolonged engagement and repeated observation were used. To enhance the dependability of this study, I maintained an audit trail of materials that documents how the study was conducted: what was done, when, and why. I maintained the raw data gathered in observations and interviews as paper documents and in computer software. My co-chair read all transcribed interviews, notes, and observations to corroborate my assertions.

**Ethical and Political Considerations**

My years of experience as a technology consultant helped define my role as both direct observer and participant observer in my study. With 10 years of teaching and training experience I have worked in a variety of schools training K-12 teachers in software and integration skills and modeling technology integration in their classrooms. Having first-hand knowledge of context factors teachers see as barriers to technology integration helped me focus on important data while observing classroom activities. I was not part of the classroom activities, but by the third round of observations, I became a familiar person in the room.

Extremely important in this study were individual rights to privacy and confidentiality. Before beginning observations and interviews informed consent was discussed and signed by participants. Appointments were made with the teachers before arriving for observations. In addition an IRB exemption 2415 was filed and approved by the university.
CHAPTER 4

FINDINGS

I began my in-depth ethnographic case study investigation of exemplary technology teachers in technology-enriched model classrooms in October 2003 and completed the study in February 2004. I 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? With the use of observations, interviews and analysis of written materials, I collected a wealth of data for my study.

Interview questions used to investigate teachers’ backgrounds and beliefs include:

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 specific practices in your school or district that have been instrumental in helping to integrate technology into your classroom?
8. How did you manage your preparation time for integrating technology?

Immersion in the data to determine patterns of behavior and cultural themes guided the data analysis. To do this, I began with coding individual case reports using NVivo2.0 software to retrieve and organize chunks of data into categories specified in the central research question: beliefs, context factors, and practices. I organized beliefs and context factors into chunks guided
by the data received from the interview questions. I coded practices 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. I then completed cross-case analysis for discovering cultural themes running through the cases.

The teachers observed and interviewed 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.

The Parish

Just as an artist frames his or her paintings, a brief description of the parish, schools, teachers, and classrooms define parameters of the observation settings. They provide context for data interpretation. Identifying those factors that were present in their teaching environments were helpful initial steps toward an understanding of technology integration.

The Louisiana Parish I visited was created in 1840, from the Parish of Saint Landry, one of the original nineteen civil parishes established by the Legislature in 1807. At one time the area became a refuge for desperadoes from eastern states and for outlaws and filibusters from Carolina, Georgia, and Mississippi. Acadians from eastern parishes of Louisiana immigrated to this area along with other families that make the population a mix of Creoles, Acadians, Americans, and Indians.

The population in this Parish is approximately 183,577 and is comprised of an area of 1,086 square miles. For several decades the chemical and refining industries and the jobs they support have remained the “bread and butter” of the Parish and region’s economy. With the approval of gaming in Louisiana, this Parish has witnessed the development of multiple riverboat
casinos that have significantly impacted the local economy in terms of employment and revenues for local government. Miles of rivers, streams and lakes offer excellent fishing, boating, and swimming, and are located in the southwestern part of Louisiana.

The middle schools in this Parish provide an educational program to students in grades six through eight. Areas of emphasis include a balanced offering of basic subjects, the teaching of problem-solving and reflective thinking, and the development of positive self-concept. Middle schools are flexible in grouping and scheduling to build a sense of community. Teachers adjust their use of time, space, and grouping arrangements in order to create the most appropriate curriculum opportunities for students.

Participants

The teachers for this study were selected from a list of teachers participating in the I-TEC grant. After studying the teacher list a decision was made to focus on the science curriculum at the middle school level. Barron et al. (2003) compared integration of computers in the classroom by subject area; it appeared that science teachers were using technology more frequently. The teachers I chose to observe and interview were Winnie Quinn, sixth-grade Science, from DMS Middle School; Sabrina Moss, seventh-grade Science from MBM Middle School; and Suzie Walker, who incorporates science and technology into her sixth, seventh, and eighth-grade Applied Technology class.

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

![Diagram showing different venues and their schedules]

Figure 1. Representation of different venues.

Purposeful sampling provided maximum insight and understanding of technology integration in middle school classrooms. It allowed sufficient time to undertake a full and richly detailed study. Very little qualitative research has been done at the middle school level and I was able to expand the knowledge of technology integration for the middle school teacher.

A visit with the Technology Implementation Coordinator enabled me to gain permission to complete the study with the teachers in the I-TEC grant. The purpose of the grant is to:

- Recognize exemplary teaching that elevates student learning in K-12 schools.
- Provide models for using technology resources to support standards-based learning.
- Offer model environment for teachers and administrators to observe quality teaching and learning infused with technology.
- Support efforts to develop and implement creative ideas that result in high student achievement.
This grant provides opportunities for teachers to engage in high-quality professional development and lead other colleagues in professional growth. The structure of the I-TEC grant provides teachers with opportunities for collegial reflection about their experiences.

By interviewing the Tech Center Technology Coordinator and the Grant Coordinator in November 2003, I learned that teachers had to apply for the grant and as part of the requirements they were to develop model technology classrooms that would be a resource for teachers and administrators to view technology integration in a classroom environment. Teachers also had to describe instructional strategies they incorporate into daily lesson design, reflecting upon personal areas of strength using technology as well as areas to improve upon. Finally, they had to describe significant change within the classroom that would have an effect on student achievement. At this time I learned that Suzie was incorporating technology and science into her Applied Technology curriculum before the I-TEC grant; however, Winnie and Sabrina were doing very basic technology activities; using websites and basic Microsoft PowerPoint presentations to support curriculum themes.

The teachers were given consent forms that explained the study (see Appendix F). The teachers were informed that pseudonyms were used for their names and the names of their schools. Each participant in the study was afforded opportunities to read, correct, and make comments on written descriptions, assertions, and interconnected components. The participants made no changes.

**Data Collection**

Before scheduling observations and interviews I learned I would have to obtain permission from the Superintendent’s office. I had to write a formal letter to the Associate
Superintendent introducing myself and explaining what I wanted to accomplish. In October 2003 I sent a formal letter requesting permission and received approval in three days (see Appendix G).

The data collection method included field observations, interviews, and collection of documents. Using direct and participant observations I followed the Spradley model (1980) with three rounds of observations: (1) descriptive, (2) focused, and (3) selective. Interviews were conducted in the teacher’s classroom with open-ended questions, during the third round of observations. Documents were collected from the school parish website. Table 3 presents a summary timeline of data collection.

Data collection began with a one-on-one interview with the Tech Center Technology Coordinator and Grant Coordinator to discover any variables that were important in the history of the three teachers chosen for the study. I also investigated how the teachers were chosen to participate in the I-TEC grant. The interview was a 20-minute, open-ended interview during which the following questions were asked: “Why were these particular teachers chosen to participate in this grant?” and “Do you know how they were incorporating technology prior to the grant?” The interview was audio-tapped and transcribed verbatim by me.

Recording in a notebook to log information, and making descriptive notes of activities, interactions, and settings I completed the first round of descriptive observations in December 2003. Throughout the month of December I spent three consecutive days of the week observing each teacher. In this first round I attempted to arrive at each school at the beginning of the school day; unfortunately, with road construction and traffic I was late.

For the second round of observations I planned arrival time for later in the morning, depending on the teacher’s schedule. Once again spending three consecutive days of the week with each teacher I completed round two of focused observations in January 2004 by using an
### Table 3

**Time Line of Data Collection**

<table>
<thead>
<tr>
<th>Task</th>
<th>Activity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submitted formal letter</td>
<td>Gain permission from Associate Superintendent</td>
<td>October 27, 2003</td>
</tr>
<tr>
<td>Interview 1</td>
<td>Data collection to discover variables that were important in the history of the chosen teachers</td>
<td>November 19, 2003</td>
</tr>
<tr>
<td>Tech Center Technology Coordinator and Grant Coordinator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation 1</td>
<td>Descriptive data gathering</td>
<td>December 2003</td>
</tr>
<tr>
<td>3 days with each teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winnie</td>
<td></td>
<td>December 3-5</td>
</tr>
<tr>
<td>Sabrina</td>
<td></td>
<td>December 10-12</td>
</tr>
<tr>
<td>Suzie</td>
<td></td>
<td>December 15-17</td>
</tr>
<tr>
<td>Observation 2</td>
<td>Focused data gathering</td>
<td>January 2004</td>
</tr>
<tr>
<td>3 days with each teacher</td>
<td>Observation tool</td>
<td></td>
</tr>
<tr>
<td>Suzie</td>
<td></td>
<td>January 6-8</td>
</tr>
<tr>
<td>Winnie</td>
<td></td>
<td>January 14-16</td>
</tr>
<tr>
<td>Sabrina</td>
<td></td>
<td>January 21-22 absent 23rd</td>
</tr>
<tr>
<td>Observation 3</td>
<td>Selective data gathering</td>
<td>February 2004</td>
</tr>
<tr>
<td>3 days with each teacher</td>
<td>Student projects</td>
<td></td>
</tr>
<tr>
<td>Sabrina</td>
<td></td>
<td>February 3-5</td>
</tr>
<tr>
<td>Winnie</td>
<td></td>
<td>February 11-12 schedule change unavailable on 13th</td>
</tr>
<tr>
<td>Suzie</td>
<td></td>
<td>February 17-19</td>
</tr>
<tr>
<td>One-on-one interview with each teacher</td>
<td>8 questions</td>
<td>February 2004</td>
</tr>
<tr>
<td></td>
<td>Data gathering</td>
<td></td>
</tr>
</tbody>
</table>
observation instrument for technology integration (see Appendix A). I did alter the use of the instrument by changing the recording of the check marks from three-minute intervals to five-minute intervals. Permission to use the observation instrument was obtained from Arizona State University (see Appendix H).

Once again spending three consecutive days of the week with each teacher I completed the third round of selective observations in February 2004. For this observation I concentrated on student activities and projects. At the end of day one of the third round of observations a one-on-one interview with each teacher was completed in the teacher’s classroom. Each teacher was asked eight open-ended questions; each interview was audio-tapped and transcribed verbatim by me.

**Winnie Quinn**

Winnie Quinn teaches at DMS Middle School located on the urban fringe of a mid-size city. DMS reported an enrollment of 323 students in grades six through eight and employed 24 teachers as of January 2004. The school uses block scheduling, which allows for larger blocks of time to allow for a more flexible and productive classroom environment (see Table 4).

Winnie holds a Bachelor of Science in Chemistry Education and teaches sixth grade physical science. She teaches three 90-minute classes of science on Monday, Wednesday, and Friday; and two 90-minute classes of reading and one science on Tuesday and Thursday (see Table 4). Winnie has a 35-minute lunch, followed by a one-hour personal planning time, and 30 minutes of team planning time every day. She has been teaching four years and integrating technology for three years. Her technology use in the classroom before participating in the I-TEC grant was very basic mostly using Microsoft PowerPoint and researching on the Internet. Students did not use technology.
She was often laughing with her students and has a good sense of humor. She never sat
during class periods, but was constantly walking around interacting with students. She rotates
student work to her Blackboard site for students and parents to view from home.

Table 4

DMS Middle School Schedule

<table>
<thead>
<tr>
<th>Block Schedule</th>
<th>Winnie Quinn’s Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeroom: 7:44-7:59</td>
<td>Housekeeping</td>
</tr>
<tr>
<td>1st Hour 7:59-9:31</td>
<td>Science – Monday, Wednesday, Friday</td>
</tr>
<tr>
<td></td>
<td>Reading – Tuesday, Thursday</td>
</tr>
<tr>
<td>2nd Hour 9:35-11:07</td>
<td>Science – Monday Wednesday, Friday</td>
</tr>
<tr>
<td></td>
<td>Reading – Tuesday, Thursday</td>
</tr>
<tr>
<td>Lunch 11:07-11:42</td>
<td>Lunch</td>
</tr>
<tr>
<td>3rd &amp; 4th Hour 11:45-1:17</td>
<td>Personal planning, teams planning</td>
</tr>
<tr>
<td>5th Hour 1:21-2:53</td>
<td>Science</td>
</tr>
</tbody>
</table>

Classroom

Winnie’s classroom (see Appendix I) has six multimedia computers labeled as computer 1, 2, 3, 4, 5, and 6 and are loaded with Microsoft Office, Inspiration software, and TimeLiner software. A laptop computer is attached to a projection unit and sits on a rolling cart in front of a long lab table the teacher uses as her desk. A screen is pulled down over a whiteboard for viewing computer projections. She has one printer, one scanner, one digital camera, and one digital video camera.

The whiteboard at the front of the class is used to list homework assignments and extra credit assignments. A handout for each assignment is taped on the board next to each
description. Students sit in blue plastic chairs surrounding six long black tables with wooden legs. Tables and chairs are situated in the middle of the room so everyone can easily see the projection screen and whiteboard. Cabinets with black counter tops and wood doors surround the room. The room is very brightly lit with 18 fluorescent lights and seven windows that let in natural sunlight across the back of the room.

A bulletin board next to the whiteboard is decorated with various settings of student pictures. Students’ work hangs from lights and includes mobiles depicting a lesson on sharp objects and electricity. Another board behind the computers contains a list of additional activities of computer assignments: Microsoft PowerPoint pictionarys and quilt squares and additional portfolio work.

Posters of computer times, group colors, group names, and when each group rotates to the computers is posted on a wall where students and teacher can easily check which students should be at which computer. The posters were created with colors coordinating to the computer and group. Student names alternate colors for ease in reading. There is a poster for each class period (see Table 5).

Table 5
Rotation Example

<table>
<thead>
<tr>
<th>Times</th>
<th>Color</th>
<th>Blue</th>
<th>Red</th>
<th>Purple</th>
<th>Orange</th>
<th>Green</th>
<th>Computer #</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:10-8:25</td>
<td>Blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>8:25-8:40</td>
<td>Red</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>8:40-8:55</td>
<td>Purple</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(student names listed under colors)</td>
<td>3</td>
</tr>
<tr>
<td>8:55-9:10</td>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9:10-9:25</td>
<td>Green</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
Portfolio folders are kept in bins for easy access. Names of honor roll students are proudly displayed on balloons. The room has beige walls and floors. The color red pops from bulletin boards, signs, and door trim.

Beliefs

Winnie believes that technology should enhance a lesson. She looks at benchmarks and determines how they fit with technology use to enhance the lesson. She says, “You can’t take your lesson and then stuff technology into it, you’ve got to have something that has to do with technology.” She believes a teacher will fail because she or he thinks, “I need to teach this lesson, what can I do with technology, and try to shove it in.” It doesn’t always work that way, “It’s like putting the horse before the cart.” She also thinks students should have a say in planning lessons with technology. She has found, “Students learn and have more ownership when they drive the lesson and they have done an excellent job for the most part.”

Winnie believes with technology integration she reaches a variety of learning styles and addresses 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 finds students take more of an interest in their work when using computers. Winnie says, “It makes them more interested when they can get on the computer then it does when we are just opening a book.”

She also believes no matter how many computers you have in the classroom; it is possible to integrate technology, “Sometimes I feel it was easier when I just had two than having six.” Winnie believes integration of computers into education is especially important and feels, “It is something kids need to know because everything in life is now on computers.” She further states, “It has to go hand in hand with education because any profession they choose, even manual labor, they have to have the knowledge and be used to it.”
**Context Factors**

Winnie had very little technology experience before participating in the I-TEC grant. She had completed some computer-based training (CBT) at the district technology center, used her personal home computer, and had attended several elementary conferences. Most of the time she solves problems with trial and error. Winnie says 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.

Once Winnie was selected to participate in the I-TEC grant she went through Louisiana INTECH, an intense, content-rich, 60-hour professional development model and framework for INtegrating TECHnology in the student-centered classroom. In addition, I-TEC teachers receive ongoing professional development in a Blackboard learning environment. Each week, a different teacher is responsible for developing an activity on the topic of choice and facilitating an online discussion.

Winnie found it hard to plan when she first began integrating technology. She says, “I was not comfortable using computers in the classroom.” Now she is using the quality management process in her class, in which students guide their own learning. She doesn’t spend a lot of time planning. She says, “Now we just dive in and see if it works. Some days it’s bad, and some days it’s great.” Winnie finds the quality process (everyone being committed to meeting the requirements of customers) and technology go hand in hand, and she knows students are learning. She states, “They are doing an excellent job.”

Winnie says 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.” Winnie’s principal is trying to get everybody involved in technology so he was thrilled
when she transferred to DMS Middle School with the computers (the hardware from the I-TEC grant travels with the teacher). He will often come to her classroom asking about technology lessons, and he’ll ask Winnie to share ideas in faculty meetings.

**Practices**

Winnie calls her class “controlled chaos.” With multiple activities for each lesson students are kept busy on the computer or at their seat. She uses a variety of instructional strategies and grouping strategies.

Winnie has her class structured as a cooperative learning environment at all times. The groups of students that make up a table in the class are intergroups in a whole class setting that have chosen names and assigned roles to the members. They have set class goals as well as group and individual goals. Within the class structure she uses multiple types of grouping for student projects. Students work alone as individuals, they work in small groups, and they work as a whole class.

All students have equal access and time on the computers. Students take responsibility for rotating to the computers using posters of computer times, group colors, and group names. As students enter the classroom they collect their portfolios from colored bins. They immediately move to assigned seats and begin working. Students work at their own pace; so all the students are not working on the same activity at the same time. Students are allowed to be independent and are responsible for themselves and their work.

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

Winnie uses Microsoft PowerPoint software to show an anticipatory assignment as students enter the classroom. She calls this assignment, “Science Pop.” She also uses 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 is able to identify appropriate, curriculum-related websites, and bookmark them into the “Favorites” folder for student use. Winnie creates checklists and rubrics using Microsoft Word and giving them to students before assigning and completing a project-based activity so they have a guide for planning their project design.

Clearly students know how to operate the hardware and software they are expected to use and Winnie was available to assist any students having problems. She demonstrates one or two computer commands with each assignment, but does not spend much time teaching computer skills. This is accomplished with peer work and peer tutoring. Using Microsoft PowerPoint students created Pictionary presentations with new science vocabulary words; they charted their grades with Graph Master software; and took pictures of energy sources with a digital camera.

**Summary**

As shown in Figure 2, I was able to identity the beliefs, context factors, and practices that led Winnie to successfully integrate technology for a technology-rich curriculum. The interconnected components of the model illustrate the relations between variables. Winnie believes technology is a tool that enhances lessons and integration is possible with any number of computers. She also believes technology enhances student learning by addressing students’ needs
and lends itself to the practice of allowing students to have a say in planning lessons. Beliefs contribute to classroom setup, context factors, practices, and technology integration.

Personal interest is an intrinsic context factor that led Winnie to technology integration. Extrinsic context factors are release time, ongoing training, and available grants. Context factors contribute to practices, beliefs, classroom setup, and technology integration. Practices fall into

![Diagram of interconnected components leading to technology integration](image)

Figure 2. Representation of the interconnected components that led Winnie to integrate technology.
two categories: teacher practices and student practices. Winnie creates a variety of activities, assumes a variety of roles, varies grouping, is skilled in technology use and is willing to take risks. Students set goals, are allowed to be independent and responsible for themselves and their learning, and are skilled in the use of technology. Practices contribute to beliefs, classroom setup, context factors, and technology integration. Winnie’s classroom is setup with tables and chairs, students have access to hardware and software, and she has developed a schedule for student rotation to the computers. Classroom setup contributes to beliefs, context factors, practices, and technology integration.

Sabrina Moss

Sabrina Moss teaches in a new middle school in a suburb in the northern part of the parish where the median resident age is 33.5 years. MBM Middle School reported an enrollment of 823 students in grades six through eight and employed 54 teachers as of January 2004. The school’s mission is to provide a learning environment in which the student will feel safe, inspired, motivated, and challenged to achieve the highest possible degree of usefulness, success, and happiness in an increasingly complex and ever-changing global society. The school schedule is seven 55-minute periods a day, five days a week (see Table 6).

Sabrina holds a Bachelor of Science in Elementary Education, a Masters in Educational Technology, and teaches seventh-grade Life Science. Sabrina teaches five classes of science every day. Her lunchtime on Monday, Wednesday, and Friday is tied up with duty. She has a 60-minute planning time every day. Her sixth hour period is allotted to team meetings, parent/student conferences, or student enhancements (see Table 6). She has been teaching 11 years and integrating technology for four years. Her technology use in the classroom before participating in the I-TEC grant was very basic. She was using Microsoft PowerPoint
presentations; students did not use technology at all. Sabrina says, “It was more a delivery type of technology.” She also stated that limited use “was mostly due to a lack of equipment.” Lack of equipment is what led Sabrina to apply for the I-TEC grant. She says, “With a one computer classroom you can do some things, but it’s a lot more difficult, especially when you only have students for 45 minutes a day.”

Sabrina is soft spoken and zooms around the school climbing up and down the stairs on a daily basis. She keeps herself and her students moving at a steady pace. She never sits, walking around the class helping students and keeping them on task.

Table 6

<table>
<thead>
<tr>
<th>MBMS Middle School Schedule</th>
<th>Sabrina Moss’ Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Hour 8:00 – 8:50</td>
<td>Science</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Hour 8:50 – 9:50</td>
<td>Planning</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Hour 9:50 – 10:45</td>
<td>Science</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; Hour 10:45 – 11:40</td>
<td>Science</td>
</tr>
<tr>
<td>Lunch 11:40 – 12:20</td>
<td>Duty – Monday, Wednesday, Friday</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt; Hour 12:20 – 1:15</td>
<td>Science</td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt; Hour 1:15 – 2:10</td>
<td>Enhancement - Tuesday Team meet - Monday, Friday Conferences - Wednesday, Thursday</td>
</tr>
<tr>
<td>7&lt;sup&gt;th&lt;/sup&gt; Hour 2:10 – 3:05</td>
<td>Science</td>
</tr>
</tbody>
</table>

**Classroom**

Sabrina’s classroom (see Appendix I) has eight computers for student use; five computers are from the I-TEC grant. Sabrina has a personal computer on her desk and a laptop connected to
a projector on a rolling cart. Four student computers sit on desks with pullout keyboards, and four sit on square tables. Roller chairs are used at the computer tables. She has three printers, one scanner, one digital camera, and one digital video camera.

Students sit in gray and silver chairs at 15 black top tables. Walls are gray and fluorescent lighting makes the room bright. Posters decorating the walls include: the scientific method, success posters, cooperative group rules, and classroom rules. Three-D bulletin boards depict science topics of the skeleton and bugs. A bookshelf holds student portfolios. The room is outlined with cabinets and windows. Two whiteboards hang on the walls for projecting and writing. A lab table extends across the front of the class and the teacher’s desk to the right of this table faces the students. A phone hangs on the wall next to the door.

Beliefs

Sabrina believes technology is a “great motivator.” She feels student participation and quality of student work has improved with technology integration. Students are more willing to come in at lunchtime, before school, and after school to complete assigned projects. Sabrina says, “They are more into quality of project, especially when they see other students and what they are able to do, it makes them more interested in improving their own skills.” She also finds student projects easier to grade, “because they know what I’m looking for and it’s set in stone.” She says, “A student sees his or her work compared to other students.”

Some students may not be good with books, but they are excellent on the computer. Sabrina finds that using technology in her classroom has given her another tool for communicating with her students. She says, “We find more things in common. Some of the lower ability level students will be excellent on the computer and this gives them another outlet for corresponding.”
Sabrina believes in “teaching the curriculum, not the technology.” She says, “Technology should just enhance what you teach.” She picks the topics she really wants to cover and then decides how technology can enhance the lesson. She says, “We’ve learned how to peer tutor.” She identifies students who are really good on the computer, and gets them to stay after school and help other students. She finds, “It’s been a great way to boost confidence of some of my students.”

Sabrina feels her teaching has moved from a traditional style to a new level. She says, “It remotivated me in my teaching skills.” She was always worried about teaching concepts and vocabulary to the students, but now she sees that students learn these while working on assigned projects. Sabrina has taken a facilitator role, watching, helping, and guiding rather than trying to get basics across to her students.

Context Factors

Sabrina’s technology skills and expertise were very limited before participating in the I-TEC grant. She was using her personal home computer and a teacher computer. She felt she needed more equipment to integrate technology and that is why she decided to apply for the I-TEC grant. She acquired her technology skills by attending IMPACT, Louisiana INTECH, and I-TEC trainings and workshops provided by the parish technology center. Sabrina first participated in integrating multi-disciplinary practices and curriculum-based technology (IMPACT), which was a 2000-2001 professional development grant that targeted five school districts in Louisiana. It focused on five critical components: (1) research, (2) problem solving, (3) reinforcement, (4) collaborations, and (5) presentations, to directly affect student achievement by integrating technology into all curriculum areas. However, Sabrina says, “INTECH was probably one of the biggest changes as far as my computer integration goes.”
The parish technology center offers classes and training sessions. Sabrina says, “If you participate in I-TEC you are on the mailing list for trainings they are offering.” MBM administration supports teachers if they leave early to attend training. The technology center personnel lend support to the schools. She says, “They have always been there when I have questions.” In addition, the school administration pushes and supports technology integration at MBM Middle School. Sabrina says, “They are very happy when we write grants.” and “They are very supportive when we ask for things.” Sabrina says not all the teachers have embraced technology integration, but the school is moving in that direction, “We still have those teachers not into it, we’re still moving into that direction.”

As students are coming into class with more skills, Sabrina finds it easier to integrate technology. She says, “As more teachers use it across the school, students are becoming more familiar with it, it’s easier to integrate, students are more comfortable with it, teachers are more comfortable, and overall it’s a good thing for our school and across the district.”

Sabrina stays at school until 5:00 p.m. most afternoons planning her lessons, but she says they are still “trial and error.” She may plan a lesson and think it will take three or four days and it could take two weeks. Sabrina says, “Your planning has to be flexible because every class and every group of students is different so you never know.” Most importantly she says, “Allow for technical difficulties, there is always something that can hinder your plan.” This is why Sabrina always has a non-technology based backup plan in case of equipment problems.

**Practices**

Because MBM Middle School has a computer lab for teacher and student use Sabrina is able to plan some lessons so her students work individually to complete projects. Working in the computer lab allows for each student to have his or her own computer to complete the
Once she sets up the learning situation Sabrina assumes the role of facilitator/coach walking around the class or lab clarifying, engaging, and motivating students.

Sabrina begins class with a Microsoft PowerPoint presentation running on the computer and projected onto the whiteboard. She plays the presentation in a loop to allow all students time to record the information in their portfolio. She calls her presentation the “Daily Agenda” because it is a list of activities and assignments for the day. She says, “This is one way parents know what students are doing in class.” She also has students record a table of contents of projects and assignments in their portfolios. Sabrina creates 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 “AskJeeves” 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.
Using technology integration in her curriculum has remotivated Sabrina. She has learned to be flexible and use trial and error in her classroom. Sabrina uses grouping in flexible ways to take advantage of lesson goals and technology availability. She had groups of four working on a “Who Dunit Mystery,” while individual students rotated to the computers for “Mystery Tree” identification. Students take responsibility for rotation to computers by tapping the next student to let them know it is their turn on the computer. With multiple assignments going at the same time students are always busy and take responsibility for themselves and their work.

The majority of Sabrina’s students know how to operate the computers to complete projects. As previously stated she uses peer tutors. She identified students who are really good on the computer to help other students learn how to operate the hardware and software they are expected to use.

Summary

As shown in Figure 3, I was able to identity the beliefs, context factors, and practices that led Sabrina to successfully integrate technology for a technology-rich curriculum. The interconnected components of the model illustrate the relations between variables. Sabrina believes technology is a tool that enhances lessons, is a motivator, makes grading easier, and aids in communication with students. She also believes technology enhances student learning with quality work and extends student work time on projects. Beliefs contribute to classroom setup, context factors, practices, and technology integration.

Sabrina’s flexibility and motivation are intrinsic context factors that led to technology integration. Extrinsic context factors include release time, ongoing training, available grants, tech support, student technology skills, and more teachers integrating technology. Context factors contribute to practices, beliefs, classroom setup, and technology integration.
Practices fall into two categories: teacher practices and student practices. Sabrina creates a variety of activities, assumes a variety of roles, varies grouping, is skilled in technology use, is willing to take risks, and includes nontechnology backup plans. Students are allowed to be
independent and responsible for themselves and their learning, are skilled in the use of technology, and have access to peer tutors. Practices contribute to beliefs, classroom setup, context factors, and technology integration. Sabrina’s classroom is setup with tables and chairs, and students have access to hardware and software in the classroom and in a computer lab. Classroom setup contributes to beliefs, context factors, practices, and technology integration.

Suzie Walker

Suzie Walker teaches at WWLM Middle School in a small city in the western part of the parish. The population of this city has increased steadily over the years, which shows prosperity and growth. With a population of 21,445 reported in 1999 the city offers a quality education, knowing what it takes to get ahead in today’s society.

This city has three middle schools with an enrollment of 1,560 students, and employing 107 teachers. The schools have a low student-to-teacher ratio, fourteen students to one teacher, making it easy for children to learn. Their mission is to provide an education that allows all students the opportunity to grow and develop to their fullest potential while acquiring knowledge, attitudes, and skills that foster lifelong, independent learning. WWLM Middle School reported 750 students in grades six through eight and reported employing 54 teachers as of January 2004. The school schedule is seven 55-minute periods a day, five days a week (see Table 7).

Suzie holds a Bachelor of Science in Math and English Education, a Masters in Educational Technology, is a National Certified Teacher, and teaches five classes of Applied Technology every day to sixth, seventh, or eighth graders. Suzie has a 55-minute planning time and a 55-minute tech time when she works on computers and mentors other teachers (see Table 7). When she visits the teachers’ lounge her 35-minute lunch is filled
with computer questions from other teachers. She has been teaching 21 years and integrating technology and curriculum for 14 years. Even before participating in the I-TEC grant Suzie’s technology skills could be classified as expert. She has taught the applied technology class for 16 years and keeps current with technology advancements.

Students describe Suzie as always having a smile on her face and say she loves to tell jokes. She is always working on a computer. Her sixth-graders study simple machines, her seventh-graders study wetlands, and her eighth-graders study national disasters.

Table 7

WWLM Middle School Schedule

<table>
<thead>
<tr>
<th>School Schedule</th>
<th>Suzie Walker’s Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Hour 7:55 – 8:55</td>
<td>Homeroom - Applied Technology</td>
</tr>
<tr>
<td>2nd Hour 8:55 – 9:50</td>
<td>Applied Technology</td>
</tr>
<tr>
<td>3rd Hour 9:50 – 10:45</td>
<td>Planning</td>
</tr>
<tr>
<td>4th Hour 10:45 – 11:40</td>
<td>Tech Time</td>
</tr>
<tr>
<td>5th Hour 11:40 – 12:35</td>
<td>Applied Technology</td>
</tr>
<tr>
<td>Lunch 12:35 – 1:05</td>
<td>Lunch</td>
</tr>
<tr>
<td>6th Hour 1:05 – 2:00</td>
<td>Applied Technology</td>
</tr>
<tr>
<td>7th Hour 2:00 – 3:00</td>
<td>Applied Technology</td>
</tr>
</tbody>
</table>

**Classroom**

Suzie works in a very large classroom (see Appendix I) with traditional student desks in one section where students sit and the teacher directs the whole class. A projector and computer are used to lecture or inform students about assignments and demonstrate a computer skill. Thirty-four computers line the other side of the room and four computers are set to the side for
students to work on special projects. She has two printers, one scanner, one digital camera, and one digital video camera. Two rolling tables can be moved around for student group work. There are also cubbies for small groups working on assigned projects.

CD-ROM mobiles hang from the ceiling as decorations. With nine long fluorescent lights and 26 recessed lights the room is very bright. There are two TV’s, one on each end of the room. One wall is decorated with a mural of white clouds in a blue sky, a tree and vines painted by Suzie. There are several whiteboards for writing and cabinets for holding books, and student work. The students hand in their work by placing it in a cubby labeled with their class hour. Once graded, the teacher moves the papers to a cubby labeled “graded” with the class hour. Bulletin boards are decorated with such items as maps, classroom rules, and school events.

Beliefs

Suzie believes that computers should be used in conjunction with the digital cameras, video streaming and editing. She believes in teaching students to use computers as tools. Suzie says, “If technology is not used in the curriculum we will lose the kids.” She says, “Students today use technology, they are the MTV generation.” She believes when teachers teach with the traditional lecture method students don't pay attention. Suzie says, “We need something that keeps their mind jumping and going.”

Context Factors

Suzie acquired her technology skills with trial and error, using a 64 Commodore, an Atari connected to her TV, and eventually attending college to take educational technology classes. However, her educational technology classes did not offer much computer training, and the only computers available for use were the Apples. The first computer used in her school was a Radio Shack TRS80 Model 4, with no hard drive, and data was saved on an eight-inch floppy disk. She
suzie says, “I learned a lot about the computers from the students.” As an I-TEC teacher Suzie receives ongoing professional development in a Blackboard learning environment.

Suzie’s computer lab has 30 to 34 computers, “depending on how many are running.” Suzie handles all problems in her lab, in addition to being called upon to troubleshoot computer problems throughout the school. She writes grants to get more computers and says, “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. She says, “As you notice I have different computers, getting one here, one there.”

By the time school starts each year all Suzie’s lesson planning is complete. She says, “I work during the summer; planning ahead of time.” She likes to plan new lessons, activities, and projects so no one gets bored.

Practices

Suzie uses a teacher-facilitator approach for project-based learning and integrating technology and science into her Applied Technology class. Learners access and utilize technology to assist them in the inquiry process. Once Suzie presents an assignment, giving instructions and a brief demonstration, students work at their own pace to complete assignments. Suzie says, “I try to give them choices.”

Suzie begins 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 teaches seventh graders and her lessons include 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 is an interactive theater software students used to write, direct, and produce a virtual theater production about the wetlands.

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

Summary

As shown in Figure 4, I was able to identity the beliefs, context factors, and practices that led Suzie to successfully integrate technology for a technology-rich curriculum. The interconnected components of the model illustrate the relations between variables. Suzie believes
technology is a tool that should be used with cameras, streaming, and editing. She also believes technology enhances student learning when they use as a tool, is a motivator, and keeps minds active. Beliefs contribute to classroom setup, context factors, practices, and technology integration.

Figure 4. Representation of the interconnected components that led Suzie to integrate technology.
Suzie’s ability to utilize student knowledge and trial and error are intrinsic context factors that led to technology integration. Extrinsic context factors include ongoing training, available grants, and contests to keep technology current. Context factors contribute to practices, beliefs, classroom setup, and technology integration.

Practices fall into two categories: teacher practices and student practices. Suzie creates a variety of activities, assumes a variety of roles, varies grouping, is skilled in technology use and creates ‘how to’ handouts. Students are allowed to be independent and responsible for themselves and their learning, have access to peer tutors, and use ‘how to’ handouts. Practices contribute to beliefs, classroom setup, context factors, and technology integration. Suzie’s classroom is a computer lab and students have access to hardware and software. Suzie utilizes a personal website for student instruction. One-half of Suzie’s large room is furnished with traditional student desks. Classroom setup contributes to beliefs, context factors, practices, and technology integration.

**Cross-Case Analysis**

I began cross-case analysis to verify cultural themes and pattern clarification by creating a meta-matrix, which is assembling data from each case (see Appendix E). Completing a variable-oriented analysis I again used variables specified in the central research question: beliefs, context factors, and practices. Looking across blocks of columns I was able to make comparisons and contrasts across variables, and to identity common components of the teachers in this study integrating technology for a technology-rich curriculum.

**Beliefs**

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 appears seamless and is integral to lesson objectives. Winnie says, “It is not an add-on that is stuffed or forced into a lesson.”

They report that students are excited about technology and enjoy using it. Suzie says, “It is a motivator; it strikes their interest and keeps their attention.” Sabrina says, “Using technology results in quality projects.”

**Context Factors**

Because of their personal interest in technology Winnie, Sabrina, and Suzie apply for grants and enter contests in hopes of receiving additional hardware and software for classroom use. 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 INTECH training was key to technology integration. As I-TEC teachers new technologies are learned with ongoing
professional development in a Blackboard learning environment. Each week, a different teacher is responsible for developing an activity and facilitating discussion on the topic of choice.

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.

**Practices**

Technology has had a positive impact on these teachers by bringing change to their teaching strategies and classroom management. An important feature of these exemplary technology teachers is the emphasis placed on creating learner-centered classrooms. Winnie, Sabrina, and Suzie provide rich learning environments and experiences with project-based learning activities that shift away from the classroom practice of short, isolated, teacher-centered lessons. They are less worried students are learning because they have 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 are not afraid to take risks and many activities are completed by trial and error. Sabrina says, “I may plan a lesson and think it will take three to four days and it could take two weeks.”

The teacher assumes many roles in the classroom, (1) directing (telling, lecturing the whole group), (2) interactive direction (directs learning and does most of the talking), (3) modeling (demonstrates a skill or strategy), (4) facilitator/coaching (students do most of the
talking and work), and (5) manager (manages class behavior and materials), rather than just an information giver. By observing the teacher’s role at timed intervals over a three-day period I was able to see different roles the I-TEC teacher assumes in the classroom. Table 8 shows what percent of time the teachers assumed each role and allowed students to work on their own with the technology.

Table 8

<table>
<thead>
<tr>
<th>Teacher’s Role</th>
<th>Winnie</th>
<th></th>
<th></th>
<th>Sabrina</th>
<th></th>
<th></th>
<th>Suzie</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Day 1</td>
<td>Day 2</td>
<td>Day 3</td>
<td>Day 1</td>
<td>Day 2</td>
<td>Day 3</td>
<td>Day 1</td>
<td>Day 2</td>
<td>Day 3</td>
</tr>
<tr>
<td>Directing (telling, lecturing whole group)</td>
<td>5.5%</td>
<td>5%</td>
<td>25%</td>
<td>21%</td>
<td>11.3%</td>
<td></td>
<td>11.3%</td>
<td></td>
<td>1.8%</td>
</tr>
<tr>
<td>Interactive direction (teacher directs learning and does the talking)</td>
<td>28%</td>
<td>22%</td>
<td>11%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modeling (demonstrates a skill or strategy)</td>
<td>22%</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitating/Coaching (students do talking and work)</td>
<td>33%</td>
<td>43%</td>
<td>49%</td>
<td>61%</td>
<td>78%</td>
<td></td>
<td>61%</td>
<td>16.4%</td>
<td>5%</td>
</tr>
<tr>
<td>Managing (behavior or materials)</td>
<td>19%</td>
<td>16%</td>
<td>3%</td>
<td>2.3%</td>
<td></td>
<td>36%</td>
<td>71%</td>
<td>82%</td>
<td></td>
</tr>
</tbody>
</table>

Note. Percents do not total 100 because the described roles were not observed throughout the entire class period, a variety of roles have occurred simultaneously, and also because of rounding.
On day one of the second round of observations Winnie took the role of interactive
director 28\% of the class time to introduce and discuss a lesson on energy resources. Directed
learning was used 5.5\% of the class time, and she assumed this role to explain to students why
they would be taking pictures with a digital camera. The role of modeling where Winnie
demonstrated a skill was used 22\% of the class time. She quickly demonstrated for students how
to use a digital camera. Managing took 19\% of class time, while passing out cameras. Once
students began the activity of taking pictures Winnie took the role of facilitator/coach for 33\% of
class time. Day two activities were a repeat of day one activities. Winnie took the role of
directing 5\% of the time, interactive direction 22\% of the time, modeling 5\% of the time,
facilitating/coaching 43\% of the time, and managing 16\% of the time. On day three Winnie
spent 25\% of class time in the role of directing, giving students information for a research project
on energy resources. She took the role of manager of materials for 3\% of class time by
bookmarking websites for students to use. During this time Winnie also took the role of
interactive directing 11\% of the time when she introduced the topic ‘plagiarism.’ Once students
began working on research Winnie took the role of facilitator/coach for 49\% of the class time.

Sabrina took the role of director 21\% of class time on day one. She began class in the
computer lab by giving students a handout to guide research on an assigned disease. As students
worked individually on the research project she took the role of facilitator/coach for 61\% of class
time. On day two Sabrina took the role of facilitator/coach 78\% of class time as the students
completed research. She managed computer problems 2.3\% of class time and shared information
for the Science Fair taking a directing role for 11.3\% of class time.

Suzie took the role of facilitator/coach 61\% of class time on day one. Students entered the
class and working in pairs moved straight to the computers. She took the role of managing
computer problems 36% of class time. Day two followed the same format as day one. Suzie took the role of facilitator/coach 16.4% of class time. Once again managing computer software problems took 71% of class time. Providing students with information and explanations, Suzie took the role of director 1.8% of class time. On day three Suzie spent most of the class period conferencing with students, taking the role of manager 82% of class time. She took the role of facilitator/coach 5% of class time.

There are many different settings in which instruction takes place: whole group, teams with three to five members, pairs, and individually. Classroom grouping and the arrangement of computers help us draw conclusions about efficient use of technology. Timed intervals of student grouping showed the percentage of time that students were grouped in various ways to take advantage of technology availability. Table 9 shows percentage of time each teacher varied student grouping over a three-day period.

On day one of round two observations Winnie’s students worked individually 8% of the 90-minute class period. Students worked in small groups 43% of the time and received whole class instruction 41% of the time. Winnie divided students into eight small groups with three students per group. Day two activities was a duplicate of day one’s lesson with students working individually 22% of the 90-minute class period. Students worked in small groups 54% of the time and were instructed as a whole class 38% of the time. On day three students remained as a whole class for 27% of class time, while Winnie explained a research project. Students worked in small groups 57% of class time, while three students worked individually 52% of class time.

On day one Sabrina’s students worked in the computer lab individually 61% of the time to complete assigned research. They received instruction as a whole class for 21% of the time.
On day two students worked individually 82% of the time and received whole class instruction 11% of the time.

Day one of round two Suzie’s students worked as pairs for 43% of the time; on day two they worked as pairs 56% of the time; and on day three they worked as pairs 87% of the time. Students worked individually to finish projects for 73% of the time on day one and 66% of the time on day two.

Table 9

Percentage of Time Students Grouped

<table>
<thead>
<tr>
<th>Student Groups</th>
<th>Winnie</th>
<th>Sabrina</th>
<th>Suzie</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90-minute class periods</td>
<td>55-minute class periods</td>
<td>55-minute class periods</td>
</tr>
<tr>
<td>Day 1</td>
<td>Day 2</td>
<td>Day 3</td>
<td>Day 1</td>
</tr>
<tr>
<td>Individual students working alone</td>
<td>8%</td>
<td>22%</td>
<td>52%</td>
</tr>
<tr>
<td>Pairs of students</td>
<td>43%</td>
<td>54%</td>
<td>57%</td>
</tr>
<tr>
<td>Whole Class</td>
<td>41%</td>
<td>38%</td>
<td>27%</td>
</tr>
</tbody>
</table>

Note. Percents do not total 100 because the described groups were not observed throughout the entire class period, a variety of groupings have occurred simultaneously, and also because of rounding.

The purpose of students’ use of technology is to engage them in authentic tasks. They can learn technology skills in the context of the lesson objectives. 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.

These teachers turn over learning to the students and students take 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 to take ownership for their learning, they are allowed to have choices and are encouraged to be creative. They are 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 complete a variety of products using paper and pencil and computer software. Computer-generated products include: brochures, newspapers, presentations, reports, pictionarys, bumper stickers, and web pages. Physical objects in the room are arranged to afford a different kind of learning environment and students change places as needed to complete assignments.

The study teachers were required to develop technology rich lessons and exercises for their students. They each have a website and showcase technology rich lessons and student work. Using a lesson plan rubric (see Appendix B) a content analysis of lessons was completed to enrich the data. The criteria listed on the rubric were used to evaluate the technology-rich lesson plans. The same scoring used by the state was used to evaluate the study teacher’s lesson plans. Characteristics described in each cell of the column with heading “3 points” were target points for all lessons. Lesson plan elements listed for evaluation include: content area, objectives, opening activities, learning activities, student-centered instruction, collaboration, concluding activities, technology integration, state technology standards, assessment, lesson materials,
modifications for special populations, extensions, resource variety, and ease of use. All lessons evaluated received a maximum score of 36.

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 5) 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. These beliefs contribute to a personal interest that motivates these teachers to apply for grants, teach themselves new technologies, and attend training. 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.

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. Lack of time for planning the use of computers has not been a problem for these teachers. 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.

Technology Integration

Technology is a tool that adds value to lessons

Personal Interest

Technology adds value to student learning and motivation

Applies for grants

Self taught

INTECH training for integration skills

Ongoing I-TEC training

Changed teaching strategies

Takes risk

Uses trial and error

Flexible planning

Project-based lessons

Varies roles

Multiple activities

Varies grouping

Peer tutoring

Independent students

Students make choices

Students responsible for themselves and their work

Student peer tutoring for tech skills and boost confidence

Figure 5. Representation of the common components of study teachers integrating technology.
CHAPTER 5

DISCUSSION

This study was an attempt to provide a qualitative examination of beliefs, context factors, and practices of three exemplary technology teachers. Using the ISTE report (2000b) an exemplary 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 their students. Because of my small number of participants, I was able to examine and describe teachers’ individual components, as well as to describe the most common components. By identifying themes that weaved their way through the data, an interconnected system began to emerge. By looking at the interconnected components that worked efficiently for these teachers I was able to identify beliefs, context factors, and practices that lead to a successful technology-rich curriculum in the classrooms. The data gathered from this study provides: (1) up-to-date information on what and how educational technology is used today; and (2) information which gives other educators an understanding of what beliefs and context factors influence teachers to integrate technology into their curriculum.

Summary

Classroom

The classroom environments in this study are such that computers were prominent and appear seamless in student activities. Results obtained in a study by Jaber and Moore (1999) indicates that access to computers influences instructional activity and frequency of use. Tiene & Luft (2001) described a model classroom designed by Kent State University equipped with 12-networked computers with Internet access, a scanner, a printer, videoconferencing cameras, digital cameras, camcorders, and a VCR. The teachers in this study had sufficient access to
computers. The hardware (five multimedia computers, printer, scanner, digital camera, and video camera) and software (Microsoft Office, Inspiration, and TimeLiner) awarded with the I-TEC grant moves with the teacher if he or she changes schools. In addition these teachers are provided with additional grant opportunities as they become available.

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 is used as a tool to support students in performing authentic tasks; students participate in defining their goals, making design decisions, and evaluating their progress.

Classes are 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.

Beliefs

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 believe technology is a tool that lends itself to better student learning outcomes. Teachers’ personal beliefs about the role of technology help 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.

When Ertmer et al. (1999) examined teachers’ beliefs about the role of technology they found that the teachers in their study used technology as a supplement, an incentive or reward for
completed assigned work. Technology was additional or supplementary to the existing curriculum. Unlike the teachers in Ertmer’s study Winnie, Sabrina, and Suzie used technology to enhance lessons and take their curriculum in new directions. Technology appeared to be seamless and integral to lesson objectives. The teachers designed activities that engaged students in meaningful technology use. These exemplary technology teachers have established a socially interactive and reflective community of practice in their classroom.

**Context Factors**

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. In March 2004 editors with ISTE’s *Learning & Leading with Technology* journal asked this question, “What is the greatest barrier to using technology now?” The results from the “quick polls” series are: a lack of time 22%, knowledge 13%, training 34%, resources 18%, and support 13%.

Teacher planning time is a key underlying context factor in determining the extent to which technology gets used. Shelly et al. (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). Training helps teachers achieve success and helps build teacher confidence that enables them to integrate technology into their classroom. Ronnkvist et al. (2000) reported that a few hardy individuals will lead the way on their own, but most need instruction. Instructional support, including individualized training, professional development activities, and professional development content that focuses on instruction and integration. 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. Each week, a different teacher develops an activity on the topic of choice.

Despite training some teachers are still hesitant and not ready to embrace technology. Research finds that a negative attitude toward computers influences the learning process. After his study Yildirim (2000) suggests one way to encourage teachers to use computers in the classroom is to increase their level of competency. Teachers’ uses of computers are now geared to gaining computer competence and less toward computer skills. This extends their approach to a more constructivist one where the computers are tools used to improve students’ communicating, thinking, producing, and presenting their ideas (Gonzales et al., 2002).

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. Winnie’s principal is trying to get everybody involved in
technology. The I-TEC 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 I-TEC teachers have implemented their student-centered
and student-directed visions within realistic environments in which technology is one
component.

Practices

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 have taken a
learner-centered approach in which their students take responsibility for their learning and
behavior. Ryba and Brown also identified key ideas on how to create better conditions for
learning. Socially interactive and reflective learning environments were identified as a key idea
for better learning conditions. The second key idea is communities of practice. The third key idea
identified was collective zone of proximal development. The fourth idea is reflective
professional practice.

The ACOT project in 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.

A teacher’s challenge is to create a classroom that supports students’ inherent ability to learn. Teachers are creating structure, providing advice, and monitoring progress as the “guide from the side” (Kozma, 2003; Tiene & Luft, 2001). 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 pictionarys, 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 create productions of wetland environments. 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 make choices about how to generate, obtain, manipulate, or display information. Reid-Griffin (2003) reported that technology enhances students’ learning of science concepts by providing opportunities to collect higher quality data efficiently and easily.
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 5, 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.

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). This study attempted to go beyond the number of available computers to describe in detail how the teachers were using computer technology and their beliefs and context factors affecting technology use as a tool. The study adds to the literature surrounding technology integration with a perspective about computer technology as a tool for teaching and learning.

The teachers in this study have a willingness to accept risk in relationship to the use of technology. 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 calls her class “controlled chaos.”

“We adore chaos because we love to produce order” (Escher, 1898-1972).

Implications

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.

**Limitations**

This study had a small number of participants in a large school system. Participants all resided within a fairly small geographical area. To enhance the possibility that this study may be informative in other contexts of similar makeup, I attempted to provide rich descriptions of the teachers and the daily events in their classrooms, and attempted to provide a description of how each teacher compared with others within the study. To avoid any threat to the trustworthiness of this research, I implemented the use of triangulation to support the results: observation, interview, and product analysis. I stayed on-site for lengthy periods of time, informed participants how the study was conducted, and described how the findings resulted from the data collected.

Time and distance did not afford me the chance to see the implementation of the lessons from start to finish. It would have been valuable to spend more time with just one teacher implementing a variety of technology rich lessons throughout the school year.

**Future Research**

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. 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. A study of personalities of teachers identified as exemplary technology leaders would be valuable. More successful technology use in the classroom across all subject areas should be observed and
reported. Future research should be done with teachers who are not identified as exemplary technology teachers to confirm or disconfirm the findings.
REFERENCES


NVivo2.0. [Computer Software]. (2002). QSR International Pty Ltd.


APPENDIX A

OBSERVATION INSTRUMENT
Integration of Technology Observation Instrument

Arizona State University West

Project Director: Keith Wetzel - ASUW
Project Manager: Helen Padgett - ASUW
Evaluator: Ray Buss - ASUW
Evaluator: Talbot Bielefeldt - ISTE

www.west.asu.edu/pt3
Recording observations using the activity record sheet

Observer: ____________ Date: ______

WATCH AND RECORD THE ENTIRE CLASSROOM, NOT JUST ONE SMALL GROUP

The observer will record the activities of the classroom at THREE minute intervals using a combination of check boxes and written notes. Begin observing and marking when the teacher indicates the lesson begins. Mark the questions in sequence. Observe for two minutes and record for one minute.

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<thead>
<tr>
<th>Time</th>
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</table>

1. Class organization - How are students working?

   NETS'T III B: III D
   MARK ALL THAT APPLY

   1. Individual students working alone
   2. Pairs of students
   3. Small groups (3+ students)
   4. Whole class

PROTOCOL: Mark ALL that apply.

RATIONAL: We expect PT3 teachers should be able to use grouping in flexible ways to take advantage of particular lesson goals and technology availability. Across all observations, we should see multiple types of grouping, although not all may be present in any particular lesson. This data provides descriptive information that helps place lesson and computer use in context. It will provide time-linked data indicating how students were grouped, (e.g., students worked in groups 60% of the time).

2. Teacher role - What is the teacher's role?

   NETS'T III B: III C
   MARK ALL THAT APPLY

   1. Directing (telling, lecturing) whole group
   2. Interactive direction whole group
   3. Modeling whole group
   4. Facilitating/Coaching
   5. Managing behavior or materials

NOTE: Focus on the teacher who is the ASUW graduate, not any other adult who happens to be present (e.g., aide, volunteer, another teacher)

PROTOCOL: Mark ALL that apply.

1. Directing: Teacher directs learning and does most or all of the talking. Provides information or explanations. Controls topic and pace.
2. Interactive direction: Teacher directs learning and does most of the talking, but asks for student's responses. For example, they may follow the IRE format (teacher initiates, students respond, teacher evaluates).
3. Modeling: Teacher demonstrates a skill or strategy, “Watch me do it” is the implied or spoken message. Aligned with instructional goals.
4. Facilitating/coaching: Students do most of the talking and working. This time is aligned directly with instructional goals. Students interact with one another, materials or problems and teacher asks questions or provides suggestions. Teacher is clarifying, engaging, or motivating one-on-one or with a small group.
5. Managing: Time on managing class behavior or This is NOT time aligned with instructional goals. Teacher is managing behavior, materials, or solving computer problems in order to get students on task.

RATIONAL: PT3 teachers should have materials organized and students trained in management issues so that most class time is spent on activities relevant to learning objectives. Teacher role as director or coach should correspond to lesson goals. This item provides descriptive data of how teachers use class time. We hypothesize that second year teachers will spend less time in management than first year teachers will.
### 3. Teacher's use of technology

**NETS** T II B: \( 3 \) D: III D  
**MARK ALL THAT APPLY**

- To present information  
- To model a skill or large group  
- (e.g., NOT coaching)  
- For grading, attendance, or material preparation  
- To retrieve information  
- Other (write in)  
- Not using

**PROTOCOL:** Note teacher use of technology. Mark ALL that apply.  
(Describe technology used. e.g., name of software, items other than computer – digital camera, PDA, etc.)

### 4. Student use of productivity tools

**NETS** S 3 B  
**MARK ALL THAT APPLY**

- Students using:  
  - Word processing, publication software  
  - Presentation software (e.g., PowerPoint)  
  - Spreadsheet  
  - Database  
  - Authoring programs (e.g., hyperStudio, video editing)  
  - Graphics or graphic organizers (e.g., Photoshop, Inspiration)  
  - Web authoring (e.g., Netscape communicator, FrontPage)  
  - Hardware (Camera, calculator, probes, PDA)  
  - Other (write in)  
  - None

**PROTOCOL:** Mark ALL that apply.  
**RATIONALE:** Becker (1999) found that students use word processors most of the time. We will be able to report the extent of use of various productivity tools by PT3 teachers and students.
5. Student use of subject specific learning tools

**NETS-S 6 A**

**MARK ALL THAT APPLY**

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<td>Students using:</td>
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<td>a) Simulation software (e.g., SimCity, SimLife, Jasper/Weather)</td>
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<td>b) Drill and practice (e.g., keyboarding tutorials, Reader Rabbit, games that teach specific facts)</td>
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<td>c) Problem solving (e.g., Thinking Things, Tesselations)</td>
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<td>d) Textbook-linked software</td>
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<td>e) Learning/Assessment software (e.g., Accelerated Reader, Star Reader, Star Math)</td>
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<td>f) Other (write in)</td>
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**PROTOCOL:** Mark **ALL** that apply. Simulation software includes software that presents a "real life" problem to students that they attempt to solve by selecting a series of appropriate strategies. The problem is complex and authentic. Drill and practice software is typically used to master basic facts (as in math) or essential information (e.g., Common Core San Diego for geography).

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6. Student use of interactive communication tools

**NETS-S 4 A**

**MARK ALL THAT APPLY**

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<td>a) E-mail</td>
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<td>b) Bulletin board, listserv</td>
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<td>c) Two-way video</td>
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**PROTOCOL:** Mark **ALL** that apply. Communication tools include those applications that allow students to exchange information with other individuals. **RATIONALE:** Provides descriptive data of type of technology, purpose, and extent of use (percent of time).

---

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7/22/02
### Segment 7. Student use of research tools

**MARK ALL THAT APPLY**

<table>
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<tr>
<th>Students gather information from:</th>
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<tbody>
<tr>
<td>CD ROM (e.g., encyclopedia or web-based databases)</td>
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<td>Internet search engines</td>
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<td>Internet web sites</td>
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<tr>
<td>Teacher's web site, Launch Page</td>
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<td>Automated library system (e.g., OPAC station)</td>
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</table>

**PROTOCOL:** Mark **ALL** that apply.

**RATIONALE:** Provides descriptive data of type of technology, purpose, and extent of use (percent of time).

### Segment 8. Purpose of research tools

**MARK ALL THAT APPLY**

<table>
<thead>
<tr>
<th>Students use technology research tools:</th>
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<tr>
<td>To locate independent searches (e.g., use self selected search strategies, key word search, etc.)</td>
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<td>To locate information under teacher direction (e.g., using teacher book marks, web page with constructed lists, teacher-specified key words)</td>
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<td>To select information by cutting and pasting, taking notes, printing, downloading</td>
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**PROTOCOL:** Mark **ALL** that apply.
### 6. Students' level of technical skills

**NETB-91**

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<tbody>
<tr>
<td><strong>MARK ONE</strong></td>
<td></td>
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</tr>
</tbody>
</table>

**Students' level of technical skill:**

1. Need lots of help
2. Somewhat skilled, but need help of teacher
3. Independent - clearly know how to operate the hardware and software they are expected to use and/or strategies are in place to assist students with problems so work is not slowed down.

**PROTOCOL:** Focus ONLY on the students using technology during this segment. **SUMMARIZE** your impression over the entire segment.

- **Need lots of help** = more than 20% of the students are unable to proceed with tasks because they are having difficulty and are waiting for teacher attention;
- **Somewhat skilled** = 10-20% of students need assistance; others solve technical problems by asking an expert, referring to aids, or other strategies;
- **Independent** = fewer than 10% need assistance; most try other strategies before asking for help. Strategies are in place so students can continue working.

**RATIONALE:** Since we are asking to observe a showcase lesson that integrates technology, we do not expect to see students still learning the technology at beginning levels. Percent of time that students can operate without direct teacher assistance is an indication that the teacher has selected a technology at the appropriate level of difficulty and prepared students with skills and strategies to learn effectively using their own or classroom resources.

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10. COGNITIVE LEVEL OF TASKS - - Declarative, Procedural, Conditional

What cognitive task(s) did the teacher set for students? (e.g., "recall...", "create...", "organize...", "compare...", "evaluate...")

<table>
<thead>
<tr>
<th>TASK</th>
<th>(-how was technology used for each cognitive task?)</th>
<th>Declarative</th>
<th>Procedural</th>
<th>Conditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PROTOCOL:

DEclarative - A task that asks students to recall or repeat information ( drills and practice software having students name the state capitals would be an example).

PROCEDURAL - asks students to apply an algorithm to a problem (create a graph from these data). They do not have to select or evaluate a strategy or algorithm. Although they are solving problems in a sense, they are not searching for the strategies that must be used, but simply applying a strategy they have been taught. (Go through this worksheet and capitalize all the proper nouns.)

CONDITIONAL - asks students to retrieve the knowledge that is relevant to a particular task. (choose which graph best represents your data; edit your paper for spelling and punctuation mistakes). The key to conditional knowledge is that students have to judge when to apply a given strategy.


Declarative knowledge is "knowing that" something is the case. The common sense use of the term knowledge usually refers to declarative knowledge — facts, beliefs, theories, opinions: precepts or passages or song lyrics; rules, names, and so on. Robert Gagne (1985) calls this category verbal information. The range of declarative knowledge is tremendous. You can know very specific facts (the atomic weight of gold is 196.967), or generalities (leaves on some trees change color in autumn), or personal preferences (I don't like lIma beans), or personal events (What happened at my brother's wedding), or rules (to divide fractions, invert the divisor and multiply). Small units of declarative knowledge can be organized into larger units for example, principles of reinforcement and punishment can be organized in your thinking into a theory of behavior learning (Gagne, Yekovich & Yekovich, 1993).

Procedural knowledge is "knowing how" to do something such as divide fractions or open a carburetor. Notice that repeating the rule "to divide fractions, invert the divisor and multiply" shows declarative knowledge — the student can state the rule. But to show procedural knowledge, the student must divide correctly. Robert Gagne (1985) calls this kind of knowledge intellectual skills. Students demonstrate procedural knowledge when they translate a passage into Spanish or correctly categorize a geometrical shape or diagram a sentence.

Conditional knowledge is "knowing when and why" to apply your declarative and procedural knowledge. Robert Gagne (1985) calls this kind of knowledge cognitive strategies. Given many kinds of math problems, it takes conditional knowledge to know when to apply one procedure and when to apply another to solve each. It takes conditional knowledge to know when to read every word in a text and when to skim. For many students, conditional knowledge is a stumbling block. They have the facts and can do the procedures, but they don't seem to apply what they know at the appropriate time. (Wootfolk, 1995, pp. 242-3).

11. How would you rate the integration of technology as it relates to the lesson objectives?

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not related to objectives</td>
</tr>
<tr>
<td>1</td>
<td>Somewhat related to objectives</td>
</tr>
<tr>
<td>2</td>
<td>Integral to the lesson objectives</td>
</tr>
</tbody>
</table>

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APPENDIX B

MAKING CONNECTIONS LESSON PLAN RUBRIC
Lesson Plan Title: ____________________________________________________________

Subject Area: ______________________________________________________________
Grade Level: _______________

Submitted By: ______________________________
Reviewed By: ___________________________

The criteria listed in this rubric can be used to evaluate standards-based, technology-rich lesson plans.

<table>
<thead>
<tr>
<th>Element</th>
<th>0 points</th>
<th>1 point</th>
<th>2 points</th>
<th>3 points</th>
<th>Item Point (s)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Curriculum and Standards</strong></td>
<td>The lesson is not focused on a content area. The lesson provides no connection to local curriculum and/or state content standards.</td>
<td>The lesson is loosely focused on a content area. The lesson provides some/limited connection to local curriculum and/or state content standards.</td>
<td>The lesson is focused on a content area. The lesson provides clear connections to local curriculum and/or state content standards/benchmarks in some, but not all major phases of the lesson plan. The target audience is defined.</td>
<td>The lesson is tightly focused on a content area. The lesson provides significant and clear connections to local curriculum and/or state content standards/benchmarks in all major phases of the lesson plan. The target audience is clearly defined.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives</td>
<td>Introductory Activities</td>
<td>Learning Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Objectives should define what students will know and be able to do.)</td>
<td>The lesson is void of any introductory (i.e. initiation/set) activities</td>
<td>Activities are disconnected and not focused on the objective.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The objective(s) is (are) imprecise or unclear or written in terms of teacher behavior, rather than student behavior.</td>
<td>The lesson introduction is somewhat disconnected from the objectives and distracts students from the learning.</td>
<td>Activities are connected to the objective but disconnected from one another.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some of the objectives are clear and some are not. Not all objectives are stated in terms of student behavior.</td>
<td>Opening activities set the stage for the lesson and are connected to the stated objectives, but lack in motivational or “bridging” value.</td>
<td>All activities are aligned with the objective(s), build upon each other, are appropriately paced, and developmentally appropriate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Each objective is stated in terms of student behavior; identifies the learning that will take place; and is measurable and observable.</td>
<td>Opening activities are relevant to the objective and provide a creative and motivating background in which to begin the lesson. There is an opportunity for active student participation and a bridge between new and old learning.</td>
<td>All activities are aligned with the objective(s), build upon each other, are appropriately paced, and developmentally appropriate. The activities are engaging, creative, and innovative.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Element</td>
<td>0 points</td>
<td>1 point</td>
<td>2 points</td>
<td>3 points</td>
<td>Item Points(s)</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Student Centered</strong></td>
<td>The lesson is not appealing to the student. There is no evidence of student choice or flexibility in pace, topic, resources, or end product.</td>
<td>The lesson is relevant and appealing, but student choice and flexibility are limited.</td>
<td>The lesson is relevant and appealing. There is evidence of instructional flexibility or accommodation of students’ interests and learning modes.</td>
<td>The lesson is relevant and appealing. It supports student choice and encourages students to be creative. At least one section is open-ended allowing students to take responsibility for their learning.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Collaboration</strong></td>
<td>Direct or whole-group instruction dominates learning experiences. Collaboration is not supported.</td>
<td>Collaborative learning allows only a few students to develop teamwork, communication, and problem solving skills.</td>
<td>Collaborative learning allows most/many students to develop teamwork, communication, and problem solving skills.</td>
<td>Collaborative learning allows all students opportunities to develop teamwork, communication, problem-solving skills, and reflection.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Concluding Activities</strong></td>
<td>The lesson contains no closure.</td>
<td>Closing activities are poorly developed and done primarily by the teacher.</td>
<td>Closing activities are relevant to the objective and provide a clear opportunity to conduct a final check for understanding, but are done by the teacher.</td>
<td>Closing activities are relevant to the objective and provide a clear opportunity to conduct a final check for understanding. Students are active participants.</td>
<td></td>
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</tr>
<tr>
<td>---------------------------</td>
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<td>-------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technology Integration</strong></td>
<td>Technology is not included.</td>
<td>The inclusion of technology is clearly an “add-on,” not complimenting the learning activities.</td>
<td>Technology is integrated into the lesson to improve the quality of student work and/or presentation.</td>
<td>A variety of technology is integrated appropriately throughout the lesson in a manner that enhances the effectiveness of the lesson and the learning of the student.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>State K-12 Educational Technology Standards</strong></td>
<td>The lesson provides no connection to the state technology standards and performance indicators.</td>
<td>The lesson provides little connection to the state technology standards and performance indicators.</td>
<td>The lesson provides significant and clear references to the state technology standards and performance indicators.</td>
<td>Emphasis on the technology standards and performance indicators are clearly seen through the major components of the lesson plan.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment (Assessment opportunities are ongoing and inform students)</td>
<td>Opportunities for student assessment are not provided.</td>
<td>Assessment opportunities are loosely identified and make limited connections to the Louisiana Content Standards and lesson objective(s).</td>
<td>Assessment opportunities are identified and require students to apply knowledge or demonstrate understanding of Louisiana Content Standards. Provide limited evidence that students have achieved the lesson objective(s).</td>
<td>Assessment opportunities are clearly identified and require students to critique, assess, and/or draw conclusions as they relate to the Louisiana Content Standards. Provide clear evidence that students have achieved the lesson objective(s).</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
</tr>
<tr>
<td>Methods for Measuring Student Achievement (Methods should include both formal and informal tools)</td>
<td>None included.</td>
<td>Limited to paper and pencil tests.</td>
<td>At least one non-paper and pencil method of measuring student achievement is included. (i.e. experiments, written or oral reports, demonstrations, projects, multimedia presentation, concept mapping, journals, portfolios)</td>
<td>Two or more non-paper and pencil methods of measuring student achievement are included. (i.e. experiments, written or oral reports, demonstrations, projects, multimedia presentation, concept mapping, journals, portfolios)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Element</td>
<td>0 points</td>
<td>1 point</td>
<td>2 points</td>
<td>3 points</td>
<td>Point(s)</td>
<td>Comments</td>
</tr>
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<td>---------</td>
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<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Lesson Materials and Resources</strong> <em>(Materials and resources—exclusive of technology tools—that are needed by the student or the teacher to execute the lesson.)</em></td>
<td>Materials necessary for both student and teacher use are not listed.</td>
<td>A sketchy list of student and teacher materials is provided. Worksheets are described, but not downloadable.</td>
<td>Materials necessary for both the student and the teacher to complete the lesson are listed. Worksheets and reproducible materials are available for immediate download from the lesson site.</td>
<td>All necessary materials are identified. It is clear what materials are referenced in the lesson (e.g. rather than saying “the handout,” it is referred to by name.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<p>| <strong>Accommodations/Modifications</strong> <em>(Accommodations generally do not change the information, amount of information learned, or the performance criteria. Modifications include changes in instructional level.)</em> | Individual needs of students are not addressed. The lesson does not contain a modification for students from special populations. | Limited diversity of learning strategies that does not enable all students to attain learning objectives. The lesson modification(s) is/are not well articulated and is/are minimal in application and conception. | Evidence of diverse learning strategies that meet the needs of students enabling them to attain the learning objectives. The lesson includes at least one modification for students from special populations. | Learning experiences are appropriate to objectives, content, and developmentally appropriate for all students to experience success. The lesson includes modifications for students from special populations. |</p>
<table>
<thead>
<tr>
<th><strong>Content, and Performance Criteria.)</strong></th>
<th><strong>Explorations and Extensions</strong></th>
<th><strong>Ease of Use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration and extension activities have not been identified for this lesson.</td>
<td>Exploration and extension activities are suggested, but have not been developed.</td>
<td>The scope of the lesson is flawed in at least one of the following ways: the time frame is too demanding; it is too limited; it is too extensive and appears to be a series of lessons rather than a single lesson; it is too</td>
</tr>
<tr>
<td>Exploration and extension activities are identified and described.</td>
<td>Exploration and extension activities challenge students to further investigate and/or apply selected standards in new and different ways.</td>
<td>The scope of the lesson appears to be manageable in a typical classroom of the targeted grade level and subject, but it has not been tested and used with students.</td>
</tr>
<tr>
<td>Resources and links have not been identified for this lesson.</td>
<td>Resources and links have been identified, however they have not been placed in APA format.</td>
<td>A rich variety of resources are identified and used in the lesson. A bibliography of sources and resources is provided.</td>
</tr>
<tr>
<td>Resources and links have been identified, placed in APA format, and all of the links are active.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A rich variety of resources are identified and used in the lesson. A bibliography of sources and resources is provided.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lesson Development Resources**

*Resources used by the teacher to create this lesson. I.e. books, journals, magazines, websites, school/public library resources, outside experts, etc.*

<table>
<thead>
<tr>
<th><strong>Lesson Development Resources</strong></th>
<th><strong>Ease of Use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources and links have not been identified for this lesson.</td>
<td>The scope of the lesson is challenging because it is time intensive and materials intensive.</td>
</tr>
<tr>
<td>Resources and links have been identified, however they have not been placed in APA format.</td>
<td>The scope of the lesson appears to be manageable in a typical classroom of the targeted grade level and subject, but it has not been tested and used with students.</td>
</tr>
<tr>
<td>Resources and links have been identified, placed in APA format, and all of the links are active.</td>
<td>The scope of the lesson is manageable in a typical classroom of the targeted grade level and subject. The lesson has been tested and used with students, and the teacher has provided</td>
</tr>
<tr>
<td>EXPENSIVE OR SPECIALIZED FOR GENERAL USE</td>
<td>REFLECTIVE COMMENTS ABOUT HIS/HER EXPERIENCES</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>TOTAL SCORE</td>
<td></td>
</tr>
</tbody>
</table>

**Scoring**
The lesson plan rubric is a tool for (1) building stronger standards-based, technology-rich lessons, and (2) evaluating lessons that are submitted to the Making Connections database. The characteristics described in each cell of the column with heading “3 points” are target points for all lessons. A strong lesson should receive minimum total score of 36.

* For purposes of the Making Connections project, a score of “0” or “1” in any one category would require a modification be made before the lesson would be placed on the site for public use.

**RESOURCES:**
APPENDIX C

DOMAIN ANALYSIS
Domain Analysis

Study of Technology Enriched Curriculum

Block
- Traditional is a kind of Schedule

Rolling tables
- Tables & Chairs
- Computer tables
- Traditional desk is a kind of Classroom furniture
- Lab Tables
- Teacher desk
- Cabinets
- Rolling cart
- Whiteboard

Digital camera
- Projector
- Desk PC is a kind of Hardware
- Laptop
- Printers
- TV

Daily agenda
- Science pop is a kind of Beginning activity

Individual
- Partner (pairs)
- Table of 4 is a kind of group
- red team
- blue team
- purple team
- orange team
- green team
- whole class

PowerPoint
- WebQuest
- Clip Art CD
- Paint
- Graph Master
- Microsoft Word is a kind of Software
- CPS – Question Author
- Internet Website
BlackBoard
Publisher
FrontPage
Producer

Portfolio
Student folder
Agenda book is a place for saving student work
Red folder
BlackBoard
Electronic portfolio

traditional desk
computer lab is a kind of classroom setup
tables & chairs

Project-based
Hands-on
Question & answer is a kind of learning
Discussion
Read a loud
Worksheets

Assigned colors
List of times
Tap next person are ways of moving to computers
Teacher sends
Lunch time
All move together

PowerPoint
Overhead
Textbooks
Projector are ways to present materials
Demonstration
Read over
Write on board

Directing
Telling
Lecturing
Interactive direction are teacher roles
Modeling
Coaching
Managing
Tutor

Watch them
Remind to do work
Call by name are ways to keep students on task
Walk around the room
Help individual having problems
Explain as many times as need

PowerPoint Pictionary
Quilt squares in Paint
Handout antonyms/synonyms
Line graph of grades
Roller coaster drawing is a kind of student product
Wetlands Brochure
Digital assessment on classification
Shark handout for classification with dichotomous key
Whodunit? Guess
Internet/identify a Mystery Tree
Graphs of fingerprints
Fingerprint database
Wetlands report
Wetlands newspaper publication
Wetlands bumper sticker
Wetlands PowerPoint
Movie production
WebPages
APPENDIX D

SPREADSHEETS
### Minutes observed on each activity for Winnie

<table>
<thead>
<tr>
<th></th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Hour %</td>
<td>0</td>
<td>15</td>
<td>16%</td>
</tr>
<tr>
<td>5th Hour %</td>
<td>20</td>
<td>22%</td>
<td>50</td>
</tr>
<tr>
<td>5th hour %</td>
<td>20</td>
<td>22%</td>
<td>65</td>
</tr>
<tr>
<td>1st Hour %</td>
<td>15</td>
<td>16%</td>
<td>16</td>
</tr>
<tr>
<td>2nd Hour %</td>
<td>45</td>
<td>49%</td>
<td>40</td>
</tr>
</tbody>
</table>

#### How are students working?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Students working alone</td>
<td>0</td>
<td>15</td>
<td>16%</td>
</tr>
<tr>
<td>Pairs of students</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Small groups</td>
<td>40</td>
<td>43%</td>
<td>0</td>
</tr>
<tr>
<td>Whole Class</td>
<td>40</td>
<td>43%</td>
<td>0</td>
</tr>
</tbody>
</table>

#### What is the teacher's role?

<table>
<thead>
<tr>
<th>Role</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directing whole group</td>
<td>0</td>
<td>10</td>
<td>11%</td>
</tr>
<tr>
<td>Interactive direction whole group</td>
<td>30</td>
<td>10</td>
<td>11%</td>
</tr>
<tr>
<td>Modeling whole group</td>
<td>5</td>
<td>5%</td>
<td>0</td>
</tr>
<tr>
<td>Facilitating/Coaching</td>
<td>25</td>
<td>27%</td>
<td>0</td>
</tr>
<tr>
<td>Managing behavior or materials</td>
<td>20</td>
<td>22%</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Teacher’s use of technology

<table>
<thead>
<tr>
<th>Use</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>To present information</td>
<td>10</td>
<td>11%</td>
<td>0</td>
</tr>
<tr>
<td>To model a skill to large group</td>
<td>5</td>
<td>5%</td>
<td>0</td>
</tr>
<tr>
<td>For grading, attendance, or material preparation</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>To retrieve information</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>15</td>
<td>16%</td>
</tr>
<tr>
<td>Not using</td>
<td>65</td>
<td>71%</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Student use of productivity tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word processing, publication software</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Presentation software</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Database</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Authoring programs</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Graphics or graphic organizers</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Web authoring</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40</td>
<td>43%</td>
</tr>
<tr>
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**Student use of subject specific learning tools**

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**Student use of interactive communication tools**

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**Students use of research tools**

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**Purpose of research tools**

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<td>85</td>
<td>92%</td>
<td>30</td>
<td>33%</td>
<td>40</td>
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</table>

**Students' level of technical skills**

<p>| Need lots of help | 0 | 0 | 0 | 0 | 0 |
| Somewhat skilled, but need help of teacher | 25 | 27% | 0 | 0 | 0 |
| Independent - clearly know how to operate the hardware and software they are expected to use and/or strategies are in place to assist students with problems so work is not slowed down | 15 | 16% | 40 | 43% | 35 | 38% | 50 | 54% | 40 | 43% |</p>
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<th>Day 2</th>
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<td>Class periods are 55 minutes</td>
<td>3rd Hour</td>
<td>4th Hour</td>
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<td><strong>How are students working?</strong></td>
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<td></td>
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<tr>
<td>Individual Students working alone</td>
<td>35 64%</td>
<td>35 64%</td>
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<tr>
<td>Pairs of students</td>
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<tr>
<td>Small groups</td>
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<tr>
<td>Whole Class</td>
<td>10 18%</td>
<td>15 27%</td>
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<tr>
<td><strong>What is the teacher’s role?</strong></td>
<td></td>
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</tr>
<tr>
<td>Directing whole group</td>
<td>10 18%</td>
<td>15 27%</td>
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<td>Interactive direction whole group</td>
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<tr>
<td>Facilitating/Coaching</td>
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<td>35 64%</td>
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<td><strong>Teacher’s use of technology</strong></td>
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<td>For grading, attendance, or material preparation</td>
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<tr>
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<tr>
<td>Other</td>
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<tr>
<td>Not using</td>
<td>45 82%</td>
<td>50 91%</td>
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<td><strong>Student use of productivity tools</strong></td>
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<td>None</td>
<td>45</td>
<td>82%</td>
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**Student use of subject specific learning tools**

| Simulation software | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Drill and practice | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Problem solving | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Textbook-linked software | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Learning/assessment software | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| None | 45 | 82% | 50 | 91% | 40 | 73% | 50 | 91% | 50 | 91% | 50 | 91% |

**Student use of interactive communication tools**

| Email | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Bulletin board, listserv | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Two-way video | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| None | 45 | 82% | 50 | 91% | 40 | 73% | 50 | 91% | 50 | 91% |

**Students use of research tools**

| CD ROM encyclopedia or database | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Internet search engines | 35 | 64% | 35 | 64% | 30 | 55% | 50 | 91% | 50 | 91% | 40 | 73% | 45 | 82% |
| Internet web sites | 35 | 64% | 35 | 64% | 30 | 55% | 50 | 91% | 50 | 91% | 40 | 73% | 45 | 82% |
| Teacher's web site, Launch Page | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Automated library system | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| None | 10 | 18% | 15 | 27% | 10 | 18% | 0 | 0 | 10 | 18% | 5 | 9% |

**Purpose of research tools**
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**Students' level of technical skills**

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<td>Need lots of help</td>
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<td>Somewhat skilled, but need help of teacher</td>
<td>15</td>
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<td>Independent - clearly know how to operate the hardware and software they are expected to use and/or strategies are in place to assist students with problems so work is not slowed down</td>
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<td>35 64%</td>
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### Student use of subject specific learning tools

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### Student use of interactive communication tools

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### Students use of research tools

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### Purpose of research tools

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<td>To locate information independently (search engines)</td>
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<td>To select information by cutting and pasting, taking notes, printing, downloading</td>
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### Students' level of technical skills

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<tr>
<th>Technical Skills</th>
<th>1st Hour</th>
<th>2nd Hour</th>
<th>5th Hour</th>
<th>6th Hour</th>
<th>7th Hour</th>
<th>1st Hour</th>
<th>2nd Hour</th>
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<tbody>
<tr>
<td>Need lots of help</td>
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<tr>
<td>Somewhat skilled, but need help of teacher</td>
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<tr>
<td>Independent - clearly know how to operate the hardware and software they are expected to use and/or strategies are in place to assist students with problems so work is not slowed down</td>
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### Day 2

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</thead>
<tbody>
<tr>
<td>1st Hour</td>
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### Day 3

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### Day 2 - Additional Data

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### Day 3 - Additional Data

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</tr>
<tr>
<td>40</td>
<td>73%</td>
<td>45</td>
<td>82%</td>
<td>50</td>
<td>91%</td>
</tr>
</tbody>
</table>
APPENDIX E

META-MATRIX FOR CROSS-CASE ANALYSIS
<table>
<thead>
<tr>
<th>Teacher</th>
<th>Beliefs</th>
<th>Context Factors</th>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winnie</td>
<td>Enhances lesson</td>
<td>Students have say</td>
<td>Ongoing training</td>
</tr>
<tr>
<td></td>
<td>Any # of computers</td>
<td>Address students’ needs</td>
<td>Release time</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Grants</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sabrina</td>
<td>Motivator</td>
<td>Quality work</td>
<td>Flexible</td>
</tr>
<tr>
<td></td>
<td>Grading easier</td>
<td>Flexible</td>
<td>Motivated</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
<td>Extends work time</td>
<td>Release time</td>
</tr>
<tr>
<td></td>
<td>Enhances lessons</td>
<td></td>
<td>Grants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tech support</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Student tech skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>More teachers using</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(table continues)
<table>
<thead>
<tr>
<th>Teacher</th>
<th>Beliefs</th>
<th>Context Factors</th>
<th>Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suzie</td>
<td>Use with cameras, streaming, editing</td>
<td>Use as tool</td>
<td>Trail and error</td>
</tr>
<tr>
<td></td>
<td>Motivator</td>
<td>Utilize student knowledge</td>
<td>Grants</td>
</tr>
<tr>
<td></td>
<td>Keeps mind active</td>
<td>Ongoing training</td>
<td>Contests</td>
</tr>
<tr>
<td></td>
<td>Technology expert</td>
<td>Creates how to handouts</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

SAMPLE CONSENT FORM
CONSENT FORM

1. Study Title: Integrating a Technology-Enriched Curriculum

2. Performance Sites: Urban Public Middle Schools

3. Investigators: The following investigator is available for questions about this study, M-F, 8:00 a.m. – 4:30 p.m.

   Julie Angers 225-673-4394
   email: jangers@cox.net

   Dr. Krisanna Machtmes, Assistant Professor
   School of Human Resource Ed.
   225-578-7844
   email: machtme@lsu.edu

4. Purpose of Study: The purpose of this research study is to determine what events, beliefs, attitudes, skills, and processes occur in the classroom of exemplary urban public school teachers integrating technology into their curriculum.

5. Subject Inclusion: Middle School Science Teachers in public urban schools
   Tech Center Technology Coordinator

6. Number of subjects: 5 Adults

7. Study Procedures: One-to-one interview of two open-ended questions with Tech Center Technology Coordinator.
   Three rounds of three days of classroom observation for each of four teachers to document and describe actions and interactions of teachers integrating technology into their curriculum.
   One-to-one interview with teachers observed of 1½ hour to 2-hours with eight open-ended questions to gain an understanding of exemplary teaching factors, beliefs, and practices in a technology-enriched curriculum.

8. Benefits: The information gathered from this study should:
   1) provide more up-to-date information on the current educational technology used today in middle school science classes; and
   2) provide information which will give educators an understanding of what factors influence teachers to integrate technology into their classroom.
9. **Risks:** Every effort will be made to maintain the confidentiality of study records. Files will be kept in secure cabinets and on a password protected computer and password protected zip disk to which only the investigators have access.

10. **Right to Refuse:** Subjects may choose not to participate or to withdraw from the study at any time.

11. **Privacy:** Results of the study may be published, but no names or identifying information will be included in the publication. Subject identity will remain confidential unless disclosure is required by law.

12. **Signatures:** The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Robert C. Mathews, Institutional Review Board, (225) 578-8692. I agree to participate in the study described above and acknowledge the investigator's obligation to provide me with a signed copy of this consent form.

Signature of Subject   Date

Study exempted by
Louisiana State University
Institutional Review Board
203 B-1 David Boyd Hall
225-578-8692
Robert C. Mathews, Chair
APPENDIX G

LETTER TO ASSOCIATE SUPERINTENDENT REQUESTING PERMISSION
October 27, 2003

Dear Mr.___________:

__________ and __________ suggested I write to you directly with my request to complete a qualitative examination and analysis of what events, beliefs, attitudes, skills, and processes occur in the classroom of science teachers in __________Parish public middle schools integrating technology into their curriculum.

First, I would like to give you a brief introduction: My name is Julie Angers, and I’m a Ph.D. student at LSU. To complete degree requirements I have to complete my research dissertation. I have chosen to observe and interview teachers integrating technology into their curriculum. I would like to get this completed this school year, starting in November 2003 and ending by February 2004.

My decision to use ___________ Parish middle school science teachers for my research was based on my preliminary research. Findings from preliminary research indicate that your school system excels in integrating technology into the curriculum. The LSU Instructional Review Board and my graduate committee have given approval. Both _________and ______ are in agreement with my plan and have encouraged me to proceed.

I am sending this formal letter requesting your approval to observe and interview at least four __________ Parish middle school science teachers. Attached is an abstract of my research plans and interview questions for your review. After obtaining your permission I will coordinate my activities within __________Parish with ______and ______.

I can be reached by email jangers@cox.net, phone 225-673-4394, or mail 36172 Beverly Hills, Prairieville, LA, 70769.

Thank you for your time and consideration.

Respectfully yours,

Julie Angers
LSU Ph.D. Student
Attachments
APPENDIX H

OBSERVATION INSTRUMENT PERMISSION REQUEST
Hi,

Sorry for the delay- I must have lost your first email in the beginning of the semester whirlwind.

Yes, it is fine to use the Observation Instrument. Attached is the most recent version 5.0. This is the complete version including the protocol. You might find the Assumptions and Development Consideration documents helpful for background information.

If your committee approves the proposal, you might find the separate Scoring Instrument easier to use. Our grant manager, Helen Padgett, has done most of the work on the instrument. She said she has some additional documents that she separated out to make data collection easier. She also has a Higher Ed version for university observations. Attached is our K-12 version. She said she'd be happy to answer any questions you may have.

Her email is helen.padgett@asu.edu

-----Original Message-----
From: Julie Angers
To: Mia Williams
Sent: 9/5/2003 10:56 AM
Subject: Fw: Integration of Technology Observation Instrument

I'm resending since I have had no reply. I'm presenting my dissertation proposal next Wednesday 9/10 and I would like to tell my committee you have given permission.

Thanks!!

----- Original Message ----- 
From: Julie Angers <mailto:jangers@cox.net>
To: mia.williams@asu.edu <mailto:mia.williams@asu.edu>
Sent: Monday, August 25, 2003 10:27 PM
Subject: Integration of Technology Observation Instrument

I am a Ph.D. student at Louisiana State University in Baton Rouge, LA. My dissertation topic is Integrating a Technology-Enriched Curriculum Ethnographic Case Study. I will be observing middle school teachers in a Louisiana School Parish. I am requesting your permission to use your Integration of Technology Observation Instrument for my data collection protocol.

If there is any further information you think would be helpful or any requirements I need for using the instrument please let me know.

Julie Angers
PhD Student LSU
APPENDIX I

CLASSROOM LAYOUTS
Winnie’s Classroom

- Chairs
- Counter
- Counter with Cabinets
- Sink
- Row of computers
- Lab Table/Teacher Desk
- Student Tables
- White board/Screen
- Presentation Cart
- Laptop
- TV
- VCR
- Printer
- Scanner
- Counter with Cabinets
- Bulletin Board
- Bulletin Board
- Bin
- Bin
- Bin
- Bin
- Bin
- Computers
- Door
- Door
- Counter with Cabinets
- Counter with Cabinets
- Windows
Julie Desonier Angers was born in New Iberia, Louisiana, in January 1953. She is the
daughter of Mildred Desonier and the late Ronald Desonier. She graduated from Mt. Carmel
Academy in 1971 and attended the University of Southwestern Louisiana (renamed University of
Louisiana at Lafayette) for one year before marrying. Julie and her husband, Joe, accepted
transfers offered with his job, moving to Pensacola, Florida; Houston, Texas; Lake Charles,
Louisiana; and finally Baton Rouge, Louisiana. During the early years of marriage Julie stayed
home to raise their three children, Joey, Nicole, and Thomas.

At the age of 37 she began working on a bachelor of business education at McNeese State
University and completed her studies in 1994. Julie then completed studies at McNeese State
University to receive a master’s in educational technology in 1997. The degree of Doctor of
Philosophy will be conferred by Louisiana State University at the December 2004
Commencement ceremony.

She was employed with Delta School of Business and Technology in Lake Charles,
Louisiana, as head of the secretary department and instructor from 1994-1996. While working on
her master’s at McNeese she was asked to be a graduate assistant as an instructor of EDTC 245
and the computer lab tech from 1996-1997. Upon moving to Baton Rouge she took a job as the
operations manager and instructor with New Horizons Computer Learning Center from 1997-
1998. From 1998-2001 Louisiana Public Broadcasting employed her as an Educational
Technology Specialist. In 1999 Julie became an education consultant working with K-12
teachers, teaching them computer software and helping to integrate technology into their
classroom curriculum. She continues to be a consultant and presents at as many technology
conferences as possible. Examples of presentations include: Handhelds in the Classroom,
Teacher Tools on the Internet, Integrating the Internet into Business Classes, Integrating KidPix,
and Teacher Technology 101.