

ASSUMPTIONS CONSTRUCTING A SCHOOL SUPERINTENDENT'S
MENTAL MODEL FOR TECHNOLOGY USE

by

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DEDICATION

The qualities of the pilot and case study superintendents made this study possible. I thank them for the trust. I dedicate this work to them.

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ABSTRACT

The continual innovation with technology in the world has caused many significant changes which have affected Montana superintendents' managerial, instruction, and political roles. The political environments of NCLB and community technology expectations created a unique context for the superintendent of the case study. Montana superintendents are learning to integrate technology into their roles to improve schools and increasing student growth. Approaches a Montana superintendent with a "high reputation" for technology implemented into his roles to improve schools and increase student achievement are documented in the study. Reasons for implementing the technological approaches answered research questions focusing on assumptions held in mental models.

Case study research with a mental model theoretical framework was used to describe technological approaches the superintendent integrated into his roles. Interviews, observations, field notes, and artifacts provided data required to describe the technological approaches. Assumptions clustered together provided the insight to understand technology approaches from emerging themes. Assumptions were drawn from themes and checked with the superintendent.

The superintendent managed his district resources in essentially a paperless office. Student records were managed with technology in his schools. Internet connections made communication instant. The assumptions of efficiency drove decisions to implement managerial technology approaches.

The superintendent's belief that students preferred learning with technology indicated a student-centered instructional leadership style. The superintendent believed tapping into students' interest in technology was a way to motivate them. The superintendent believed that alignment of student learning preferences with instruction was important. To integrate technology into instruction required professional development in order to make teachers comfortable infusing technology into instruction to deliver content, technological assessment approaches, and continuous visibility to sustain political support.

The assumptions held by the superintendent that affected the superintendent's approaches to integrate technology through his roles were 1) leadership's belief that student learning preferences with technology were important, 2) leadership belief that technological learning and instruction should be aligned, 3) leadership's belief that teachers needed professional development to become comfortable with technology, 4) leadership's belief that alternative technological assessment data were superior to yearly AYP results, and 5) leadership's skills in fostering supportive relationships created a political shared will.

CHAPTER 1

INTRODUCTION

Converging National Educational Priorities

President Clinton challenged the nation's educators, parents, government, community, and business leaders in 1996 to work together to ensure that all children in America are technologically literate by the dawn of the 21st century. In his *State of the Union Speech* 1996, President Clinton created a vision for technology in schools, "In our schools, every classroom in America needs to be connected to the information superhighway, with computers and good software, and well-trained teachers" (p. 1). This vision of technology in American education has since occurred at various levels of use at each local school. Cuban (2001) explained that schools have made great gains in acquiring new technologies for schools. Decision and policy makers have based decisions about purchases of powerful computer technology use in schools on assumptions and beliefs regarding technology use in schools.

Cuban points out President Clinton's explicit assumption: computers and internet access will improve American education. Superintendents have found this assumption about technology use in schools problematic. Political expectations to deliver the vision of internet access placed superintendents in the middle of technological change. School facilities needed new technology related infrastructure. Instructional expectations placed teachers in the middle of technological change. Students learned to use computers outside of school and brought new knowledge to the curriculum, much of this knowledge

was unfamiliar to school staff. Piccianno (2002) wrote some teachers began implementing computers and the internet into classes, while others resisted technological change in early years. Many teachers did not receive formal computer training and many thought computers were a too impersonal approach to teaching. While managing change in their schools, superintendents were also managing changes to their own roles. Email, word processing, and the internet have become common tools for communicating ideas and accessing data (Piccianno, 2002). Stakeholder pressures on superintendents to implement technology created new visions for districts. Consequently, technology demands for limited resources became political; the need for professional development to integrate technology into the curriculum became essential; and implementation of technological change in schools emerged as another role responsibility of the superintendent.

The Federal role in education was transformed by the *No Child Left behind Act of 2001* (Public Law 107-110). President George Bush stated, “And we owe the children of America a good education. And today begins a new era, a new time in public education in our country. As of this hour, America’s schools will be on a new path of reform, and a new path of results,” as he signed the *No Child Left Behind* legislation commonly known as NCLB (2002, p.1). States were asked to develop accountability systems.

Superintendents were challenged with the new accountability paradigm. Technology integration and content accountability reforms converged on the superintendent’s roles. Technology savvy superintendents turned to technology for help. Networked computers connected the entire school community, allowing efficient communication of

information; the integration of technology into administration of schools involves, “at its core,” the efficiencies of information sharing (National Center for Education Statistics, 2003).

Under NCLB, each state must measure every public school student’s progress in reading and math in each of grades 3 through 8 and at least once during grades 10 through 12. By year 2007-2008, assessments in science for grade spans 3-5, 6-8, and 10-12 must be initiated (United State Department of Education, 2004).

“President Bush announced last week that the federal government is supporting a largely private effort to create an Internet warehouse of student-achievement and other data collected under federal law. The project will post every state's test-score data and provide search and sorting tools to help users compare how well schools reach specific demographic groups and teach certain subjects, and gauge schools' overall performance. It also will provide a financial analysis that quantifies each school's success at improving student performance” (Hoff, 2003)

The explicit assumption that accountability would increase student learning changed the educational landscape for superintendents. These political changes required superintendents to learn new technological knowledge and skills to meet NCLB demands.

Montana legislators also demanded better schools. The State of Montana has mandated inclusive political processes to improve schools with its *Planning Guidebook and Reporting Forms: Montana Five-year Comprehensive Education Plan ARM 10.55.60 (Five Year Plan)*. Districts were required to build a district level education profile. Additionally, the Five-Year Plan required every school in the district to develop a comprehensive education plan. Johnson (2004) reported that superintendents are harnessing more powerful data tools and greater amounts of data. Spotting trends in dropout rates, grades, gender, and demographics from reports generated from student

information systems have helped superintendents collect and report data to the Montana Office of Public Instruction (OPI) to meet legal requirements. Additionally, districts must file technology plans and receive approval from OPI for federal funding. To qualify for Federal e-rate funding and Title II-D funding programs, a technology plan must be approved by the Montana Office of Public Instruction (OPI) (Michael Hall, personal communication, 10-04-2006).

Superintendents face political issues resulting from school technology planning requirements. Local school boards are participating and signing off on strategic technology planning. Technology has superintendents communicating to school trustees and stakeholders in various ways to gain support for general levies and special technology funds. Assumptions regarding technology a superintendent holds in a political environment could be significant. Peterson and Barnet (2004) wrote, “As a result of the growing national and local pressures for school reform and performance standards, superintendents’ power was further eroded, forcing them to build political coalitions, gain the support of a variety of external stakeholders, and develop strategic plans for school improvement.”

The *Billings Gazette*, (May 10, 2006, p.1) headlined, “Thirty-three schools in Montana told to restructure” for falling short of No Child Left Behind requirements. Schools and administrators across the nation face unprecedented consequences. Data-driven decision making is essential to school improvement (Schmoker, 2002); yet a dearth of research exists about superintendents’ assumptions regarding the use of technology to report and use disaggregated data to influence teaching practices.

Furthermore, little is known about the assumptions superintendents hold regarding technology practices to help students meet NCLB requirements. Brunfield (2005) wrote,

“As computers and the internet become increasingly important to both the business and instructional practices of school districts, a growing number of boards are making an understanding of technology and how it can be used to enhance school operations a key factor in their search for a new superintendent” (p.1).

Instructional leadership since NCLB has become more relevant than ever for superintendents, as they make curricular decisions regarding technology. Zigarelli (1996) concluded there was no evidence linking the superintendent to improved student performance. However, NCLB required processes involving instructional leadership in schools to define, align, and review curriculum. Benchmarks were established and student testing required instructional leaders to access data to improve student achievement. Failing to meet state targets required tutoring at district expense. Parents can move their students to higher-performing schools at the expense of the under-achieving school. So, school districts not only lose state funding derived by per pupil membership, but may face loss of funds due to transportation, as sanctions get increasingly problematic by continued underachievement. Carter and Cunningham (1997) pointed out, “Certainly a key concern of superintendents is very tight fiscal resources” (p.66).

Technological advances have given superintendents new tools to lead school improvement efforts. With the rapid transition into the digital age, school leaders face new managerial, instructional, and political pressures. In the forward to *Using Data to Improve Schools: What's Working*, (2003) Paul Houston, Executive Director of the

American Association of School Administrators, wrote, “As educators shift their focus from simply reporting test results to using the data to improve instruction, data become essential ingredients in school improvement” (p. iii). With the continued emphasis on accountability, school leaders will continue to be responsible for collection, analysis and interpretations of multiple sources of data in strategic planning to improve schools and increase student achievement. Superintendents’ approaches and assumptions regarding the use of technology to report and use disaggregated achievement data to influence teaching practices in the curriculum are unknown. Furthermore, assumptions superintendents hold regarding technology practices to help teachers meet NCLB requirements are unknown. The *National Technology Assessment, 2005-2006*, reported districts with all schools meeting AYP requirements spent significantly more per student on technology than districts with one or more schools not making AYP (QED, 2005). To replicate better performance, there must be an understanding of the context of improvement as well as strategies (Fullan, 2002). By understanding the approaches and assumptions held by superintendents, a better understanding will emerge regarding technology integration and its possibilities to improve schools and student performance.

The superintendent’s symbiotic relationship with technology in schools has been leveraged by legal requirements, parent and student expectations, community values, teacher needs, district financial resources, and a host of emerging issues of security, safety and effectiveness. These factors require consideration in the superintendent’s thinking and decision making about technology use in public schools. School leadership curriculum has been developed at the University of Minnesota to help administrators

navigate the technology effect in schools. McLeod and Hughes (2005) *School Technology Leadership initiative (STLI)* included school technology policy issues including equity, intellectual property, and technology plans. Additionally, their curriculum covered school technology safety and security issues for elementary and secondary schools. Besides data security required by Family and Educational Rights and Privacy Act (FERPA), topics included safety issues like school security cameras, internet access filters, computer managed locks, school biometrics, cyber bullying, and cyber crime. Training for school leadership is important because technology decisions that superintendents' make may have negative consequences on students and their achievement including health risks, reduced learning from poorly designed software, decreased creativity, frustration from computer breakdowns, wasted learning time, and incorrect information found online.

Superintendents like others in American society have been immersed into an environment filled with technology. McKeachie and Svinicki (2006) noted that by fall of 2002, 99% of public schools had access to computers and 61% of U.S. households were connected to the internet. "K-12 public school districts spent an average of \$6.38 billion on all technology purchases during the 2004-2005 school year, a 5% increase from the year earlier" (QED, 2005, p.7). Email, word processing, and the internet have become common tools for communicating ideas and accessing data for superintendents according to Beaverhead County High School Superintendent, F.L., Chouinard (Personal communication, August 28, 2007). The superintendent's assumptions about technology are based on learned experiences with technology that cross over from personal contexts.

Both the professional and personal contexts contribute to the technological world view of superintendents making a unique mental model. Hanks (1998) pointed out that, “Psychology, linguists, philosophy, anthropology, and rhetoric, have all, at various times, highlighted the importance of context for thinking (p. 50). Consequently, these thoughts form the assumptions that guide subsequent thinking, and serve as a reference for decisions and subsequent actions regarding technology use in schools. “Without the ability to learn, store, and recall how we should respond to environmental dangers, knowing when to run or fight and even how to run or fight, the individual has small chance of survival” (Wolfe, 2001 p. 74). Unfortunately, little has been written about superintendents’ assumptions and their connection to actions regarding technology.

The affects of all this stimuli on the superintendent’s thinking, regarding technology, is stored in memory. Senge explains, “Our ‘mental models’ determine not only how we make sense of the world, but how we take action” (1990, p.175). Ruff (2002) elaborated, “Perceptions of an event or situation as well as response approaches to the perception stem from the mental models used to represent and make sense of the variety of stimuli competing for attention every conscious second” (p. 12).

Unfortunately, an effective model for technology use in public schools doesn’t exist; therefore, superintendents have had to make their own assumptions of efficacy regarding technology from their own contextual experiences.

Situated cognition, regarding technology use, makes each superintendent’s frame of reference unique. Constructing knowledge from contextual experience is supported in constructivist theory (Petraglia, 1998). Assumptions learned -good or bad- from

experience in an individual's roles are stored in memory and used to guide perceptions, goal development and problem-solving approaches (Argyris 1993, Kim, 1993, Ruff, 2002, Senge 1990). Hansman advanced the idea that each superintendent has learned in context and incorporated the knowledge in unique ways into the superintendent role (2000).

Argyris' work alerted researchers to the fact that actions may be incongruent with thinking. Argyris (1993) wrote that individuals are guided by two theories of action: "espoused theory" and "theory-in-use". A paradox between espoused theory and theory-in-use arise when superintendents communicate one way and act differently. The incongruence between words and action is not fully understood, but further research may lead to a variety of influences and pressures affecting the superintendent's assumptions that guide technology use in schools. This confusion may impede school improvement efforts and decrease student achievement.

Superintendents have not only had to learn about technology and make technology decisions for their districts, but they have also had to incorporate technology use into their daily work routines in order to have time to meet job demands. There have been attempts to define technology knowledge and skills needed by superintendents, for example, Technology Standards for School Administrators by the International Society for Technology in Education (ISTE). The standards advocated the use of technology in six areas of superintendent responsibilities: (1) leadership and vision, (2) learning and teaching, (3) productivity and professional practice, (4) support, management and operations, (5) assessment and evaluation, and (6) social, legal, and ethical issues. How

technology is to be used in these areas is determined by each superintendent's assumptions of appropriateness and efficacy. Superintendents have helped shape the technology landscape in schools by envisioning, organizing processes, implementing policies, and budgeting for technology. They have had their roles of school leader influenced by technology. The details of the superintendent's mental model of technology use are obscure; however, rich contextual information is available regarding assumptions superintendents hold of technology use.

Leadership was critical to technology integration in technology planning, modeling, leading technology change, and professional development in technology (Armstrong, 2000; Battle, 2004; Calhoun, 2004; Hoffman, 2003). The reason leadership was critical to integrating technology remain unknown. Furthermore, purposes to integrate technology into instruction are not known. The technology approaches used by Montana superintendents to increase efficiency and effectiveness are not known.

Technological approaches supported by superintendents to improve schools and increase student achievement lack description of both approach and rationale. This creates problems for superintendents at decision points, as they make decisions to integrate technology under the pressure of achievement scores.

Problem Statement

The changing technological landscape coupled with federal accountability demands has had a significant affect on the roles of superintendents. Little research

exists to help superintendents develop mental models to integrate technology into managerial, instructional, and political roles to improve schools and student achievement.

No research existed regarding assumptions Montana superintendents hold regarding the effect of technology on their roles. Yet, leadership has been found to be essential to successful technology effects in schools (Armstrong, 2000; Battle, 2004; Hoffman, 2001; Poole, 2003). Carter and Cunningham point out, “The effective superintendent must use the power of technology as a catalyst for high standards, assessment, and accountability; for professional development; for getting students active and motivated; for parent engagement; and for decentralization” (p. 226). It is unknown how superintendents are accomplishing this with technology. Assumptions guiding innovation for technology approaches used by superintendents regarding high standards, assessment of student achievement, data for accountability, professional development are unknown. No known model exists for superintendents to follow to accomplish goals improving schools or increasing student achievement with technology. Innovating with technology in a high stakes environment requires courageous leadership. Effective technology models need to be described because not all superintendents are in position to risk innovation.

Montana superintendents have lead technology change in their schools like other superintendents across the country. Presidents Clinton’s vision of every school connected to the internet has resulted in a host of assumptions that have lead Montana superintendents to built computer infrastructure into their facilities. Montana superintendents have developed inclusive processes required by law to plan the

technology effect in their districts based on assumptions of importance. Subsequently, teacher training has occurred in the use of computers, the internet, and various software packages. This training has initiated new chains of assumptions by teachers, students, parents, and community members. The blend of assumptions guiding superintendents through this change is not known. Unanswered questions about assumptions regarding computers, software, personal hand-held devices, cell phones, laptops, smart boards, internet connections, infrastructure, security, health, training, change, funding, political support, and technology processes arise about the technology effect on superintendents thinking.

Montana superintendents have undergone an unprecedented change by the effects of technology in their multi-faceted roles. Through this change process assumptions have been made which are unknown. This creates a learning opportunity to uncover technology's efficacy to improve schools and student achievement..

Purpose of Study

The purpose of this research is to understand the technology experiences of superintendents in their roles. This case study identified and described technology approaches used by K-12 Montana superintendents' with highly regarded technology reputations. The assumptions guiding approaches provided rationale for technology use in their managerial, instructional and political roles. The emerging information from Montana superintendents will provide new information for learning. This learning

provides new knowledge of technological practices and reasoning for superintendents to improve schools and student achievement.

Research Questions

This qualitative case study examines assumptions superintendents hold regarding technology approaches in their managerial, instructional, and political roles in K-12 Montana school districts. (1) What assumptions guide technology approaches in managerial roles? (2) What assumptions guide technology approaches in instructional roles? (3) What assumptions guide technology approaches in political roles?

Significance of Study

The increased infusion of technology into Montana public schools has changed the superintendent's roles. With greater reliance on technology to improve student achievement, manage business operations, communicate with communities, and rely on data for decision-making, understanding assumptions of superintendents with highly regarded reputations for technology can be used to transform educational practices in Montana schools. Not all Montana superintendents have political support to innovate. The possibility of error in a high stakes environment could be costly. The lessons from those who can innovate with technology to improve schools and student achievement are valuable. If there was greater understanding of models of effective use of technology in day-to-day practice, others could implement new effective practices with little worry. With an understanding how resources were equitably distributed in schools, others could

use these approaches and the associated rationale. New visions of technology in superintendent roles allows others could see new possibilities for technology. Innovative approaches to technology integration into the curriculum encourage others to learn new methodology. New perspectives could improve staff training. Emerging problems associated with technology may start others thinking of solutions. Technology approaches used by superintendents in their roles could be improved by others, who see new possibilities.

Learning may change one's thinking and world views improving mental models. Understanding the assumptions guiding actions of superintendents with highly regarded technology reputations in schools may be used to improve student achievement and schools with technology. The assumptions of superintendents regarding technology in this study will contribute to the dialogue for improving leadership thinking and may ultimately improve superintendent training. Additionally, the emerging issues or problematic circumstances generated by the research questions may communicate a need for further study. Montana educators could see new approaches with technology and understand the associated reasoning allowing decisions to be made regarding the importance of technology within their superintendent roles.

Definition of Terms

Definitions for this study follow, for the purpose of reader clarity:

- *Assumptions*: A string of rules stored in memory that reflect values and guide actions. Assumptions are learned generalizations at times confused with empirical data. (Senge, 1990).
- *Mental Model*: Thought models that allow perceptions of reality. These thought models allow mental modeling of problems, events, or processes allowing the individual to predict, interpret, or refine views before acting. (Craik, 1967).
- *Five-Year Comprehensive Education Plan*: Montana School Accreditation Standard 10.55.601 is an inclusive stakeholder accreditation processes required by Montana of schools. Districts and schools develop plans for purposes of improving student achievement through extensive data review and school improvement.
- *School Board*: Trustees governing local school districts collectively (MCA, 20-3-301).
- *Superintendent*: Chief executive officer in a school district with multiple roles (Carter and Cunningham, 1997).
 - *Superintendent's Instructional Role*: Work of superintendents in curriculum, instruction and staff development characterized by the articulation of a vision, creation of an organizational structure that supports the vision and leadership, assessment and evaluation of personnel

and instructional programs and organizational adaptation (Peterson, 1999).

- *Superintendent's Managerial Role*: Work of superintendents with clerical characteristics focused on facilities, budgets, and operations (Carter and Cunningham, 1997).
- *Superintendent's Political Role*: Work of superintendents involving building partnerships, collaborations, and inclusive processes within a political organization. Support of schools is received from voted levies of partisan and bi-partisan constitutes (Kindrid, Bagin, and Gallagher, 1984).
- *Technology*: Electronic system of input, process and output put to use in schools to improve efficiencies, increase learning, and enhance communications. (Picciano, 2002).
- *Trustee*: An elected official to the local school board (MSA, 20-3-301).

Assumptions

The trustworthiness of the study is based on a set of assumptions and for the sake of disclosure is set forth. It is extremely important that respondents answer accurately to describe their practice in context. Evidence exists that the superintendents are concerned with improving technology use in their Montana K-12 schools and using electronic technology to be more efficient. This research design presumes superintendents make decisions regarding technology, have a planning process and use technology for diversified purposes. Furthermore, there is an assumption that superintendents have

individual beliefs regarding technology efficacy in K-12 public schools and that these beliefs guide their approaches in practice. Although it can not be predicted what issues, perceptions, or theories will emerge, an assumption that there is an important relationship between assumptions and technology use exists. Additionally, it is assumed that technology has affected on superintendent's political, instructional, and managerial roles.

Research Approach

A case study design using grounded theory methodology provided a framework for this research approach. By purposefully selecting superintendents with highly regarded reputations for technology, interviews, observations and artifacts could provide information to describe technology approaches. From these descriptions, inferences can be made in further analysis. Inferences in the form of assumptions were member checked for accuracy. Although there was particular interest in the use of technology in schools by the researcher, there was no agenda accept to report technology approaches used by the selected superintendents. By using a pilot case study, there was refinement of design and methodology. The cases provided insight by being reported in significant detail to describe. Multiple perspectives were gathered in field observations and interviews, as well as relevant documents relating to technology approaches used by superintendents in their roles. Particularly important was continued reflection of both participants and the researcher on information collected. Reflection created sensitivity for continuous coding through information collection and analysis phases of the research. The information gained from this research approach provided understanding of the assumptions

superintendents hold guiding their approaches to technology in their roles. The usefulness of this information may be direct application of approaches and reasoning for superintendents implementing technology in an accountability era.

Research Design

The chapters of the research design focus on the case study. The pilot case study can be read in Appendix A. Chapter II reviews the literature related to leadership theory and technology practices. Literature provided a historical perspective on three roles of the superintendent. While still having managerial responsibilities, the importance of an instructional leader role has emerged. The multi-faceted roles are often ambiguous and over-lapping. The era of NCLB puts pressure on superintendents to make sure their students perform. The converging reforms of technology and accountability create an environment politically sensitive. The importance of change theory and learning theory in this environment are essential to superintendents. Chapter III explains the case study design and the importance of the pilot case study. The discussion of the research design includes methods and procedures. Chapter IV presents the descriptions of technological approaches. The associated assumptions are inferred after being checked for accuracy with the case study superintendent. The methodology is presented including particulars of protocols. Chapter V presents findings and implications. Questions that remained unanswered suggest further research.

Summary

Superintendents have had their schools change with the emergence of technology. They have had to manage change caused by technology in a political environment, while managing change in their roles. Technology is a powerful medium that has had unprecedented consequences in schools, to learning, and effect on community. Coupled with accountability demands by federal legislation, superintendents must provide leadership in improving schools and student achievement. Therefore, the study of leadership in schools is tremendously important. It is not only important to understand what superintendents are doing with technology in their roles, but why they have chosen to do so.

Superintendents are tackling the challenges of integrating technology with assumptions in a variety of contexts. These assumptions guiding their approaches to technology in their roles have not been studied in Montana. These assumptions guiding approaches to technology may have tremendously important impacts on schools' success improving student learning. Without learning the assumptions guiding efficacy in technology approaches, issues confounding to practitioners remain unsolved.

Consequently, the study of assumptions guiding technology approaches matters greatly to those concerned with improving schools and student achievements. Underlying assumptions provide rationale, reasoning for decision making and problem solving with technology approaches. Describing approaches and checking inferences in the form of assumptions is a way to understand what is important to superintendents and why they feel the technological approach is worth time and resources.

CHAPTER 2

LITERATURE REVIEW

Introduction

Technology in Montana K-12 school districts has affected superintendent roles with various degrees of efficacy. “Technology has the potential to reshape education, ending the disjunction between schools and their communities” according to Carter and Cunningham, (1997, p. 218). As this integration occurred, the superintendent’s role experienced a technology effect. Montana superintendents have learned new technology skills as the landscape changed from technology infusion to content accountability. One change that the superintendent has had to lead is technology integration into schools. The importance of technology integration into school has been subject to debate. Calhoun (2004) wrote

Given the difficulty of implementing change in public education, in general, executive leaders such as superintendents, can inadvertently stop successful advancements in the realm of technology improvements simply from a lack of understanding or awareness of what the relevant issues even are (p.11-12).

Superintendent Roles and Technology’s
Effect on their Roles

The managerial, instructional, and political roles of superintendents are often defined by the political body doing the hiring. The Educational Policies Commission of the National Education Association of the United States and the American Association of School Administrators stated, “In some places the board assigned responsibility which

emphasized the managerial roles of the superintendent, such as school building and business problems, in other contexts, the board looked to the superintendent for leadership in instruction and in training of teachers” (EPC, 1965, p.8).

Arizona superintendent Calvin Baker has lead a technology change from textbooks to laptops. Fundamentally, the district has transitioned to technology to frequently monitor a strong standards instructional model, using technology to design, deliver, and analyze achievement. “Our students will be living and working in a world where technology will be integral to most everything they do” (eSchool news, 2007, p.27).

According to Superintendent Mark DiRocco of Lewisburg Area School District in Pennsylvania, the emergence of the web has allowed students to increase their learning well beyond the classroom. He has facilitated a training-the-trainer program that provides a new computer to teachers every three years, while providing 12 hours of training related to technology each year. DiRocco has connected the entire district in order to communicate both long term and immediate information of interest to students, staff, parents, and community (eSchool News, 2007).

Superintendent’s Managerial Role

The original role of the superintendent was schoolmaster with trustees making nearly all important decisions. Carter and Cunningham say, “Its earliest role was clerical, assisting the school board with the day-to-day details of school activities” (1997, p. 23). Griffiths (1966) defined the role of the superintendent as businessman with schools

fashioned after industrial models based on scientific management practices. This conceptualization created a centralized bureaucracy with the promise of greater productivity and efficiency. The superintendents' role focused on the physical plants and structural needs rather than the instructional programs (Burry, 2003). By 1907 in Montana; Anaconda, Billings, Bozeman, Butte, Great Falls, Helena, Kalispell, Lewistown, Livingston, Miles City, Missoula, and Red Lodge had school superintendents (Brewers, 1907). Business management trends helped conceptualize the role of the superintendent as manager, which continues to be a traditional role, accepted in current practice (Burry, 2003).

Effects of Technology on the Superintendent's Managerial Role

Superintendents' approaches to the role of manager have been changed by current technology. Stand alone computers with accounting software had migrated into schools from business applications prior to *No Child Left behind Act (NCLB)*. School clerks were using spreadsheets and data bases applications. The technology priority of the Clinton administration, networking computers to the internet in schools, changed many fundamental practices of superintendents managing schools. Superintendents were more connected to budgets, communications changed, and new thinking about technology integration occurred. NCLB requirements made the tasks of data collection, storage, and reporting unmanageable without subsequent software and connectivity. Superintendents had to take time to learn new technological methods.

The Montana Office of Public Instruction (OPI) developed online technology data bases to help school leaders report data for the NCLB. The OPI technology system, Internet Resources Information Service (IRIS), helped superintendents, who had technology skills, gather information for data-driven decision-making to improve student achievement. Superintendents have retrieved data through password access to eleven independent variables in five different areas for analyzing adequate yearly progress (AYP). Montana superintendents report all sorts of data online for their districts (1) drop out rates, (2) student races, (3) achievement scores, (4) teacher assignments and certifications, (5) schedules, (6) attendance, (7) graduation rates, (8) pupil instruction related (PIR) days and (9) school discipline (OPI, 2007). As additional areas of the curriculum are assessed, student achievement reporting data will continue to increase. State of Montana IRIS system has been integrated with Montana's *Comprehensive Five Year Plan for School Improvement*, which meets federal NCLB legislation requirements. The change to a technological approach in Montana affected knowledge and skills required by superintendents in their managerial role.

Superintendents are managing business operations with technology. Spreadsheets keep superintendents current on budgets in general accounts, student accounts, activity account, technology accounts and specialty accounts. Electronic spreadsheets allow manipulation of budgets, enrollment projections, tests scores, and aid in incremental data in teacher negotiations. Office automation with office "suites" has allowed communication with words, graphs and pictures. Electronic mail with picture and document attachments is commonplace (Picciano, 2002). Data bases of inventories of

books, desks, tables, computers, printers, etc. are managed with technology. The technology effect on the business of public school education changed the school management approaches of superintendents. “*The School Administrator* talked with a number of school leaders, some of whom have worked with Hirsch [a superintendent], for whom the new technology has become an indispensable way of doing business” (Pardini, 2007).

The Superintendent’s Political Role

The superintendency is by nature a political role because of the governance structure surrounding it. The political nature of the role leads to diverse expectations: some mandated and some presumed. Superintendents are increasingly stretched as expectations are added by federal legislation, state mandates and local pressures (Sergiovanni, 2000).

The political birth of the superintendent position has continued to be inherent to the role’s nature. In 1845, Vermont’s legislature passed a law creating positions of county and town superintendents. Vermont’s commissioner of Education Cate (2006) describes the superintendents’ roles:

“The county superintendents were required to visit each town in their county each year in order to advise the town superintendents and to administer teacher licensing exams. The town superintendents were elected by the voters of the town. They had to visit each school in their town at least once a year and they too administered teacher licensing exams. The county superintendent positions were eliminated in 1849 because of efficiency concerns and transportation difficulties. The town superintendents were in place until 1915, except for a two-year hiatus from 1889 to 1891” (p. 2).

The battle between contextual perceptions has matured the political role of superintendent. Superintendents were challenged by social changes of the 1960's and 1970's. The turbulent times spilled over into the schools and the superintendent as expert was challenged on several fronts. Equity issues surfaced as disadvantaged students chronically underachieved. The Civil Rights era brought several legal mandates from disenchanted citizenry, which the superintendent role as expert had few answers. Superintendents found themselves in defensive positions looking for new answers for a politically motivated public (Glass, 1992).

In reality, the superintendent's role demands the performance of myriad tasks many of which are defined by different perceptions. Kowalski (2001) wrote that board members may have philosophical differences that lead to different role expectations. Differences in role expectations may exist between teachers, community members, students, universities, and legislators causing ambiguity for individuals serving in the superintendency. With political problems associated with leadership in education, the role of manager is often the easiest road and safest role for careers of superintendents (Fenwick, 2005). The necessity of bringing diverse groups together with a common vision and set of goals requires inclusive process skills inherently political.

The Effects of Technology on the Superintendent's Political Role

Superintendents have faced political pressures to integrate technology into schools on many fronts including national legislation. "Students and parents are forcing teachers to learn how to utilize the microcomputer, and teachers, students and parents are

putting pressure on educational administrators and governing boards to purchase and use computers in all phases of education” (Tanner and Holmes, 1985, p.8). The evolving political role has created tension for practicing superintendents. Governance issues and policies have had to be developed for acceptable internet use. Employee blogs are cropping up in school districts and superintendents need to have processes available to ensure smart policies (Car, 2007). Superintendents have had to provide advice to trustees on infrastructure for networks, computer lab designs, software adoption, selection of hardware, and contracted services for internet access.

“Although the two groups have never really accepted a clear separation of policymaking and administration, they must now deal with their differences in a more politically intense environment, one that induces reaction rather than production. In this context, superintendents receive mixed messages” (Fenwick, 2005, p.160).

Balancing tight budgets with increasingly expensive technology requests has Montana superintendents going to voters to approve technology funds and new general budget appropriations.

A Rand (2005) study measured the density of computers in schools and found increasing density per enrolled student in schools. The study found that the rapid penetration of computers in the mid 1980’s suggests that many computers in schools are relatively old and outdated. The study found that computers in the early 1990’s had little internet capacity, while small hard drives made them functionally limited in the educational setting. The study acknowledged that most of the computers were Apple computers or IBM clones, which leant themselves to keyboarding skills, but little else.

Superintendents and school trustees are faced with tough decisions regarding technology upgrades as technology agenda items at school board meeting appear for approval.

The superintendent's use of technology to communicate keeps constituents engaged in inclusive processes. Calhoun's (2002) research of technology skills of superintendents indicated that 100% of the respondents reported using email a lot and 87% thought it was very important. Superintendents indicated 93% responded that they used word processing, while 87.5% reported using an internet browser. Superintendents are posting policies, handbooks, agendas, minutes of board meetings, and notices on web pages to inform constituents. The technology effect on the superintendent's political role has included pressures to commit resources, time, and energy. Consequentially, superintendents have had to take political risks in inclusive processes relating to technology. These inclusive processes regarding technology integration into schools require political skills.

Superintendent's Role as Instructional Leader

A reasonable amount of research exists that leads to conclusions that schools can develop into places of teaching and learning excellence; however, left without leadership often do not (Allington and Cunningham, 2002). The emerging role of superintendent as instructional leader shifts the focus to a collaboration between central office and the school (Wimpelberg, 1987).

The Educational Policies Commission of the National Education Association of the United States stepped beyond an abstract role definition as manager of budgets and

personnel to a role definition supported by actual conditions in which superintendents' operate. The focus of the superintendent's role became the over-all responsibility of the instructional program of the schools (EPC, 1965).

The role of the superintendent has changed as increased demands for performance data increased in the standards and accountability era. As state criterion was established with benchmarks for student achievement and new processes for improvement that included all stakeholders, the role of the superintendent as instructional leader has gained new prominence. As instructional leaders, superintendents are focusing on providing students in Montana schools with an adequate education measured by state targets. The importance of hiring well-trained instructors is significant to improving student achievement (Allington and Cuningham, 2002).

Instructional leadership has been defined by several sources (Cuban 1988; Carter and Cuningham, 1997; Lashway, 2002; Peterson, 2001; Peterson and Barnett, 2004; Valdez, 2007:) as leadership with visionary characteristics, shared understandings, focus on student achievement, understanding the importance of staff training, planning change, and aligning purpose with instruction.

Montana superintendents lead school improvement efforts in 2001 as instructional leaders by working to align curriculum with Montana standards (OPI). MonCat was hired to develop criterion-referenced tests, while superintendents lead efforts to develop well organized curriculums.

Survey and interview data of Southwest Educational Development Laboratory (SEDL) reported that educators perceived the instructional leadership role for district

leaders included setting and defining expectations, monitoring school performance, understanding school data, involving themselves in classrooms and alignment of standards, curriculum and assessment as top role responsibilities (Hall and Hord, 2006).

The Effects of Technology on the Superintendent's Instructional Role

Prior to 1980, microprocessors were large and expensive and for the most part out of the budgetary reach of public schools, but as hardware and software decreased in price public schools began to integrate computer technology into their programs (Piccianno, 2002). Technology has affected both the nature of work in schools and the preparation of students for the world of work.

Being both effective and efficient in our use of information technology ensures that it becomes a benefit in our work and not an obstacle. Not everybody is comfortable with computers and there are many instances where fear of the unknown has caused untold stress to the novice user. But for the beginner and experienced user alike there is usually at least one trick or tip that can make our work, and us, more productive (Storey, 1999, p. 8).

Transmission of digital images in picture and video streams or word and numerical data streams has changed the nature of human work. The Secretary's Commission on Achieving Necessary Skills (SCANS) report (1993) reported worker technology competencies including:

- Acquiring and evaluating data, organizing and maintaining files, interpreting and communicating using computers to process information.
- Understanding social, organizational and technological systems, monitoring and correcting performance, and designing and improving systems.

- Applying technology to specific tasks, maintaining and troubleshooting technologies. (p.4)

The affects this is change in environment on human learning is still in the process of being understood. It is known that instruction now includes technology in various degrees in schools. The effectiveness of the technology in instruction on learning is generally subjective. Prensky (2001) suggests that the digital world in which students live has caused changes to their learning styles. He has refers kids growing up after 1980 in the digital world as “Digital Natives.” According the Prensky, Digital natives are native speakers of digital language of computers, video games, and the internet. He suggests that there have been changes to digital native brains, that new patterns of thinking from technological inputs have changed the way their brain process information. Individuals, not born into the digital world have been termed as “Digital Immigrants.” Digital immigrants have adapted to the digital world with various degrees acceptance. This suggests that students and teachers are fundamentally different. This technology influence (see Figure 1) have a profound impact on superintendents trying to meet achievement standards with a gap between learning and teaching styles.

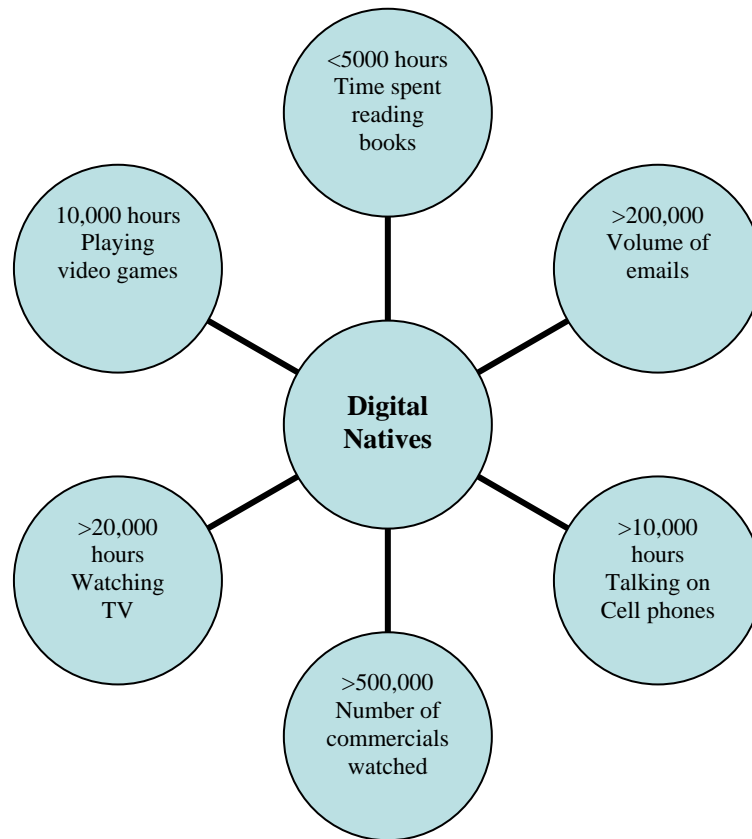


Figure 1. Prensky's Theoretical Model.

Wolfe (2001) concluded from brain imaging techniques that different instructional approaches affect the brain differently. Wolfe came to the conclusion that it was important to match instruction to how the brain learns best. Wolfe said, "Learning is a process of building neural networks." Wolfe admits that rarely does neuroscience prove that a particular classroom approach works better than another, but PET (Positron Emission Tomography) scans can track brain activity.

For example, PET scans of a reader show that much more frontal lobe activity occurs when the subject reads silently than when he or she is reading aloud to others. Activity in the frontal lobes often indicates higher-level thinking. On the other hand, the scan of the student reading out loud glows brightly in the motor

area of the brain that governs speech, while showing little activity elsewhere. One way to interpret these scans is that there is more comprehension of what is read when one reads silently (p.11).

Experimental research by neurologist, Gary Small (2008), “The current explosion of digital technology not only is changing the way we live and communicate but is rapidly and profoundly altering our brains” (p.1). His brain research contends that fast paced digital information does sharpen cognitive abilities.

We can learn to react more quickly to visual stimuli and improve many forms of attention, particularly to notice images in our peripheral vision. We develop a better ability to sift through large amounts of information rapidly and decide what’s important and what isn’t –our mental filters basically learn how to shift into overdrive. In this way, we are able to cope with massive amounts of information appearing and disappearing on our mental screen from moment to moment.

While the brains of today’s Digital Natives are wiring up for rapid fire cyber searches, neural circuits that control the more traditional leaning methods are neglected and gradually diminish. (p. 21)

Small’s research addressed the questions, (a) How much impact extended computer time was having on the brain’s neural circuitry, (b) How quickly extended computer time build up new pathways, and (c) Whether or not brain changes could be observed and measured as they occurred?

With the hypothesis that computer searches and other online activities would cause measurable alterations to the brain neural circuitry, Small enlisted neurophysiology and neuro-imaging experts. They did MRI (Magnetic Resonance Imaging) on volunteer test subjects in two groups. One group had internet search experience and the other group was naïve to the internet. To prevent extraneous error in brain stimulation, a test control of reading a book was used. This allowed them to subtract measurements

from brain activations from reading. After the first MRI scanning session, the two groups searched the internet for an hour a day for five straight days.

The results showed while reading their brains showed little difference. Both groups knew how to read from years of experience. By contrast, the two groups showed distinctly different patterns of neural activity while searching the internet. Distinct patterns of brain activity were activated in the left front part of the brain, the dorsolateral prefrontal cortex. The naive subjects showed little or no activation in this area. With more internet interaction, the naïve subjects rapidly began to trigger activity in the dorsolateral prefrontal cortex. This area of the brain controls the ability to make decisions and integrate complex information. It also controls our mental process of integrating sensations, thoughts, and working memory. Consequently, today's younger minds have fundamentally different circuitry than their parents and grandparents.

Small said, "Today's dizzying pace of high-tech innovation not only presents a challenge for those of us raised before there was a computer on every desk, but is actually altering the neural wiring of tech-savvy young people's brains –changing the way they develop and function, and turning the normal generation gap into something new: a widening chasm I call the brain gap" (p. 24). Small's research suggests individuals using technology engage a particular part of their brain creating neuron-networks from technology use. Jukes and Dosaj (2006) explained the connection of brain research to education,

What current brain research used in conjunction with psychological research does allow us to do is to make inferences and gain understanding as to why and how our children's experiences with the digital landscape are impacting their brains and minds so we can make good educational decisions. The bottom line is, if we can't

connect with as our children and build relationships with them by understanding their learning and communication practices, and applying this understanding to classroom practices, no amount of energy, money or mandates will increase student achievement or address the challenges of state standards or No Child Left Behind (p. 24).

Superintendents, as instructional leaders, have unique influences over the learning because they are school decision-makers. Brain research provides superintendents with new perceptions of learning with technology.

Situational Awareness and the Changing Role

In reality, the superintendent is a virtual *mad-hatter* of sorts guided by his or her perception of the events influencing the instructional program of their school district. The overt assumption that superintendents are responsible for everything that happens in the district can cause stress for the individuals in the roles. McGarity and Maulding, (2007) “Using today’s superintendency as an administrative platform, current literature describes a preponderance of stress in school leadership” (p.1). Much of this stress is due to the expanded role responsibilities and the variation from district to district in authority to carry out expectations (Carter and Cunningham, 1997).

The role of the superintendent may be perceived differently depending on the issue view points or the perception of the relationships in context. Fenwick (2005) uses five conceptualizations of the role of superintendent as the role of superintendent has evolved: superintendent as teacher-scholar, superintendent as manager, superintendent as democratic leader, superintendent as applied social scientist and superintendent as communicator. “Superintendents not only are expected to assume at least five distinct

roles, they must know when to shift emphasis from one to another” (Fenwick, 2005, p.160).

Contextual differences create unique role expectations for superintendents. “These contextual variables may include (1) characteristics of districts, schools, and communities; (2) the nature of values, needs, and wants being expressed; (3) conditions at any given time (e.g., economics, social relationships); and (4) the people who are involved” (Kowalski, 2001, p. 11). The role of superintendent may be shaped by their novel personal values, abilities, and skills. Besides the individual’s unique worldviews, the role of superintendent has a degree of ambiguity pertaining to the contextual expectations and perceived needs in a political forum. Burry (2003) found “that learning to deal successfully with one board did not ensure their success with a different board either within the same district or when new to a district” (p.116).

Most people understand that the superintendent is the person in charge of the schools, but what superintendents do actually remains vague (Lashway, 2002).

“Although most historical analysis imply that a specific role of the superintendent may have dominated in a particular time period, other scholars, however, suggest that superintendents have always been expected to blend multiple roles, each of which might have dominated the scene in earlier years” (Peterson and Barnett, 2004, p.2).

Technological approaches used in the superintendent’s roles have brought new assumptions to school contexts, unavailable to their historical counter-parts.

The Importance of Change
Theory to Superintendents

Burry (2003) reported that various issues emerged in research with New York superintendents including tasks and competencies, including state and federal reporting regulations, understanding of standardized test scores, changing relationships with principals based on new leadership capacity theories, and changing organizational structures.

The challenge of superintendents, as practitioners, is to develop a learning organization that shares a vision of how to improve schools and that inevitably involves change. Administrators are often trapped in the “quick fix” mentality. Boards, at times, may want administrators to “fix the parts” or “fix the people” or “fix the school” or “fix the system.” “The emphasis of this schema on ‘fixing’ various entities may help identify where to begin a change effort; however, it is unlikely to result in long term, systemic change” (Valdez-Perez, Milstein, Wood, & Jacquez, 1999, p. 2). This “fixing” mentality by-passes a critical process of change, namely inclusion of stakeholders’ input. It could lead to defensive routines by staffs, which in the end are counter-productive to improvement strategies.

In 1965 The Educational Policies Commission offered a view of the role of superintendent:

He seeks a consensus of his board, community, and staff on the goals of the schools as a basis for decisions on the program. He constantly seeks opportunities to create conditions in which the climate for learning and the work of teachers may be improved. He encourages his staff to suggest further opportunities for improvements. A typical need is to help teachers keep abreast of advances in

their respective fields. It is the superintendent's responsibility to draw together teachers, specialists, and administrators in planning for meeting this need (p. 3-4). Facing the reality of school improvement's enormous complexity, administrators forge ahead working with the dynamics operating within the district: unions, trustees, special interest groups, teachers, and students. "The intangible and often invisible assets of an organization reside in individual mental models that collectively contribute to the shared mental models (Kim, 2003, p.17). The superintendent must build the necessarily relationships to communicate issues and concerns honestly in order to enter into any change strategies. Leadership practice, however, is a delicate, complex equation because trust is a multi-faceted, multi-level concept. It operates at four levels: the individual, the organizational, the interpersonal and the community level (MacBeath, 2005). With this thought in mind, priorities of teachers have to be addressed before they will be willing to change aspects of the system that they assume are working fine. Surfacing their concerns offers instructional leaders a starting point for collaboration needed to agree on strategies for improving schools and student achievement.

Charged with the task of making certain that every student receives a quality and equitable education that will allow them to succeed in an ever more challenging world, superintendents must understand change to make certain improvement occurs in a consistent, sustained way. The process of building a shared vision with a systems thinking approach is an inclusive communication process that looks at the system "holistically". Superintendents must collect, interpret and communicate school system data and their links to standards, curriculum, instructions, and assessment in the NCLB era. By continually working for system coherence, policies and rules have to be reached

through learning agreements, through shared thinking, and through shared organizational visions (Hall and Hord, 2006). “Superintendents must develop approaches that create support mechanisms, encouraging input, conversation, collaboration, direction finding, goal setting, risk taking, significant action, and broad support for educational improvement (Carter & Cunningham, 1997, p. 78).

Waters, Marzano & McNulty (2003) describe two types of change (a) first order being adaptive to system factors that already exist and (b) second order as an emergent change affecting organizational values and norms. Superintendents must find common avenues to pursue with constituents, especially when addressing change. Waters, Marzano & McNulty, (2003) go on to explain,

To the degree that individuals and/or stakeholder groups in the school or school system hold conflicting values, seek different norms, have different knowledge, or operate with varying mental models of schooling; a proposed change might represent first order change for some and a second order change for others (p. 7).

Hall and Hord (2006) recognized the profound influence of organizational culture. They emphasize the importance of organizational culture to systemic organizational change. Organizational assumptions have been learned through shared experience. These basic assumptions of acculturated beliefs, values, perceptions, thoughts and feelings create organizational traditions. Superintendents, who understand that shared organizational values are based on shared assumptions, can work within accepted boundaries to influence patterns of behavior. Basic assumptions in organizational structures, processes, goals, visions, and philosophies give individuals rationalizations and justifications for their actions. It is important to make the right assumptions about people, ask the right questions and give the right assistance (Maxwell, 1993).

Mental Model Theory

Craik's (1943) initial thesis contended that individuals constructed internal models of the environments around them. This allowed for an explanation of an engineer who was capable of building small-scale models prior to building the real thing. This framework of envisioned internal constructions of the external world could also be manipulated with predictions. Furthermore, inferences from the internal models could be made allowing refined decision-making. Craig (1967) hypothesized that humans carry "a small-scale model" of external reality within their head which allows them to try out various alternatives for decision-making. They can thus react to future situations before they arise, utilize their knowledge of past events, and react in a fuller, safer, and more competent manner to current life events.

Fundamentally, mental model research concerns itself with understanding human knowledge of the world (Norman, 1983). People's views of the world, themselves, and their capacities to perform and learn depend on mental conceptualizations they bring to the tasks. Through interacting and learning, people develop internal mental models of themselves and conceptualizations of the world. Johnson-Laird (1983) advanced the notion that individuals needed language semantics to create mental representations of the world. Their theory challenged language theorists, who believed that syntax provided the sole structure for representing reality. Byrne (1992) connects reasoning skills and cognitive skills in her model theory of deduction. Her view explains how mental models guide plans individuals make, reach decisions and solve problems. Her cognitive research is an extension of the syntactic view of thinking of logical inference; however,

logic alone couldn't explain inconsistencies of views and actions. Byrne advanced the theory that cognitive deductions were premises of mental inference rules.

The Importance of Superintendents Understanding Mental Model Theory

Whether the superintendent is operating in the political, instructional, or managerial role, the superintendent who understands the concept of mental model representations has a method to understand underlying assumptions of constituents. In turn, communication can be clarified with inquiry and advocacy enhancing learning. Senge (1990) through learning humans can re-create themselves allowing new perceptions of the world and their relationship to it. New knowledge and skills can increase constituents' capacity to adapt, to create, and to envision new possibilities. Superintendents can be more effective with inclusive change approaches with the knowledge of mental models. O'Malley and Draper (1992) theorize that "knowledge is distributed across a number of internal knowledge structures" (p.3), which leads to the notion that mental models can be internalized in groups as norms.

Pope (1993) points out the importance of anticipating teacher thinking for organizational learning. Understanding mental models allows superintendents to predict other points of view. The leadership strategy of distributed leadership and shared decision making encourages collaborative thinking for effective actions. The applied utility of mental models for superintendents is the ability to develop individual learning to improve the effectiveness of the system. Furthermore, superintendents can predict consequences of actions and predict behavior.

Importance of Mental Model Theory to
Superintendents Implementing Technology

Motivated by the fact that technology is becoming increasingly more prevalent and complex, mental model theory can help leadership understand the difficulties in learning, effectively using, and integrating systems with technology. The problem for superintendents is that technology use needs to be more effective due to accountability demands, yet computer users are often less sophisticated than the system they are expected to operate and the students they are expected to teach. The superintendent's role as instructional leader becomes essential in teacher professional development. The ultimate goal of mental model development is skillful use, essentially, the internalized practice for flexible use in context (Bibby, 1992).

Teachers, who are expected to report grades, keep attendance, and communicate student progress, using a technological system, may have learning barriers that the superintendent needs to address. Expectations for integrating technology into lessons, while staying focused on standards may cause confusion Sasse (1992). "One of the truisms of human-computer interaction (HCI) states that users of complex devices - such as computer systems - build and use some form of mental representation of those devices. These representations are often called mental models" (p. 225).

Human computer interaction (HCI) has become important to the achievement of students. Computer misuse can absorb valuable instructional time, waste precious funding and create systemic problems. To understand the relationship between superintendents and computers, key issues regarding computers users need to be

addressed, such as, (a) how instructions are provided to develop mental models users, (b) how training in instructional pedagogy is provided for learning technology, (c) how policies surrounding computers guide use of stakeholders, (d) how demands of computers affect employees, (e) and how superintendents themselves learn technology. “From this perspective, mental models are seen as the implementation of the differing knowledge bases enabling the operator actively to gather information, make inferences, anticipate outcomes and make plans for future decision-making” (Rogers, 1992, p.5).

When a system is designed, it is designed around a conceptual model. This conceptual model governs the entire interface with the system, so that the system is seen by the user as consistent, coherent and intelligible. This is what Norman (1983) calls system image. Thus, if instructors of the system teach the conceptual model to the user, and the system image is consistent with that image, then the user’s mental model will also be consistent. The superintendent, who recognizes mental model limitations, can make learning accommodations for teachers, students and community members. For this learning to take place the conceptual model must meet three criteria: learnability, functionality, and usability according to Norman (1983). Often, there is little correspondence among the designer, the system image, materials taught to the end user, and the mental model of the end user. This can result in system ineffectiveness and failure.

Superintendents implementing technology into schools might learn from other organizations implementing technological changes. With the pervasive integration of technology into both business and educational organizations, research was conducted to

study the affect of leadership implementation strategies. MIT researcher, Orlikowski (1992) explored organizational issues of implementing Lotus Corporation's *Notes Groupware* into Alpha Corporation. The firm used an "evangelistic" approach through the chief information officer's in-service training to introduce the change. Many of the employees mentioned reading about the change in technology at Alpha Corporation in trade journals. The Alpha Corporation leadership assumed that software, which allowed collaboration and group interaction, would improve the organization's effectiveness. The results revealed "people's cognitions or mental models about technology and their work and structural properties of the organization as significant influences to effective utilization" (p. 2). The research indicated that employees received relatively little communication about the changes and were left to make their own assumptions about the technology. This caused confusion in the workplace, which was a significant problem, because many of these people reported lack of understanding of the purpose of the change.

Mental Model's Relationship to the Superintendent's Approaches to Technology

The superintendent needs methods to uncover ineffective perspectives of staff in order to improve instruction. Understanding assumptions that guide views allows leadership to develop strategies for improving mental models. Surfacing views, offering alternative views, and developing learning plans with teachers are a method of improving mental models.

By studying mental models regarding technology in school systems, conceptual models can be created for the domain of technology use in schools. By understanding their own assumptions regarding technology, superintendents can navigate inclusive change processes with some confidence. Ruff and Shoho (2005) studied three principals to understand the meaning of instructional leadership. Even though the words the three principals used were syntactically similar, the meaning attached to the words reflected internalized perceptions unique to each principal's assumptions. The discussion of semantic differences in issues, conditions, and words of the three principals linked their assumptions to their actions in schools. This research illustrates the importance of self-understanding and reflection to the superintendent to ensure that political, instructional, and managerial visions are consistent with collaborations.

Argyris (1980) wrote "Let us begin by asserting that people hold maps in their heads about how to design, implement, and monitor their actions" (p. 12). Furthermore, individuals hold both espoused theories and theories-of-use. Argyris' research concludes that individuals don't always behave in congruence with their espoused theory; however, they do behave congruently with their theory-of-use. This incongruence can cause many problems for superintendents when making decisions, which expect one action and experience another. In the political arena unexpected incongruence can cause problems lacking explanations. A teacher espousing a theory for the need for a computer in their class and not using it may lead to mistrust in superintendent decision-making skills by political powers, which in turn may affect other organizational decisions.

Cuban (2001) challenges the technology assumption that more computers mean more learning. Cuban studied technological rich schools and found 48% usage by staff in one school and 74% usage of computers by staff in another school, which indicates a large variation. He suggests this is a result of leadership's view of technology's value and the value of teacher preparation in technology; however, no explicit documentation was made regarding the consistency gap of technology use and its connection to leadership views.

Anticipating how teachers view technology learning, technology integration into content areas, system technology, technology planning and technology policies can make technology users in school systems either efficient or inefficient. Superintendents, who discover mental model limitations to technology, can implement strategies to help learning. Duff (1992) suggests that mental models develop during learning which support the knowledge base during problem solving. Duff used an experimental approach to determine the importance of prior knowledge and its relationship to internally held representations of technology devices. The over-all effects were summarized as knowledge forms play a role in accuracy and speed of action execution during both learning and problem solving of technological system parts. Furthermore, the forms of knowledge figurative, operative and exploratory make a difference in the learners' mental representations of the system. This suggests stages of learning and mental model development. Initial learning was helped by figurative and operational procedures, but lost meaning in context. Exploratory learning with prior knowledge resulted in internalized learning with flexible applications.

Bibby (1992) “One type of instruction that the computer user often needs to gain is knowledge of how the computer achieves the goals that the user has” (p. 153). To understand the importance of connecting technology use and the users’ context is a tenet of Bibby’s research. Applied to professional development in technology, a superintendent could achieve more effective integration, if the technology is relevant to the teachers’ context. Improving mental models through learning may be counter-productive if the learner sees no connection with context. Bibby found that learners of technological systems rely on several different kinds of representations for their learning and essentially avoid passive approaches. Mental model building in technology is therefore a process that evolves from dynamic use which requires the interaction of several learning devices presented in a variety of ways. The notion that the learner adheres to one learning representation is too limiting for developing skillful use.

Senge (1990) advances the argument that “mental models” are one’s worldview. Therefore, stakeholder worldviews of technology play a key role in the elaboration or constraints of technology use in schools.

More specifically, new insights fail to get put into practice because they conflict with deeply held internal images of how the world works images that limit us to familiar ways of thinking and acting. That is why the discipline of managing mental models –surfacing, testing and improving our internal pictures of how the world works –promises to be a major breakthrough for building learning organizations (Senge,1990, p.174).

The shared mental model seems an easy prescription, but with individual assumptions about technology use, views often differ. Superintendents need to understand change theories to help them bring about organizational learning and systemic change.

Senge (1990) elaborates the problem of believing the assumption is a fact. A host of emerging defensive routines can take superintendents by surprise by not addressing the mental model issues. The importance of surfacing the issues, making them public, and gaining a current view of reality can help superintendents understand mental models of constituents, which can help organizational change. Contradictory beliefs that are not addressed often become obstacles to improved conditions for learning, such as assumptions that dreams are impossible. “Given beliefs in our powerlessness or unworthiness, structural conflict implies that systematic forces come into play to keep us from succeeding whenever we seek a vision (Senge, 1990, p.157).

The importance of understanding mental models for leaders can not be understated. Kim (1993) “The cycles of individual learning affect learning at the organizational level through their influence on the organization’s shared mental model” (p.15). Leading others involves their acceptance of new visions, values, beliefs, actions and interactions. Revisions are agreed upon and shared visions stored in memory as a mental model of the organization, governed by shared norms and values (Kim, 1993). The superintendent needs to look at the whole system and use learning agreements, through shared thinking, and through shared organizational visions.

Technology Responsibilities of the Superintendent

As integration continues to occur in Montana schools the superintendent’s political, instructional, and managerial roles will be critical to the function technology plays in their district schools. Poole (2006) indicated active support from district

leadership as the most important tenet of successful technology integration into schools. Integration of technology in schools is most successful when it is well-planned, integrated and closely monitored for effectiveness according to Poole. Additional tenets of successful programs involve ongoing technology training for teachers and restructuring of teacher time to prepare for technology integration into the curriculum. These are all within the realm of the superintendent's roles and according to Poole's research essential to successful technology integration.

The belief that superintendents can close the digital divide with technology planning, which integrates technology into their schools, is a fundamental hope to provide technology learning for all students. Gorski (2001) "digital divide" has traditionally described inequalities in access to computers and the Internet between groups of people based on one or more social or cultural identifiers. The inequalities of access may result from affluence, disability, race, sex, or demographics.

Montana superintendents have responsibilities for technology planning processes to improve schools. Technology planning for K-12 public school is tied to federal funding. To qualify for Federal e-rate funding and Title II-D funding programs, a technology plan must be approved by the Montana Office of Public Instruction (OPI) (Michael Hall, personal communication, 10-04-2006). OPI has a criterion for *Montana's Integrated Technology Plan's* acceptance: clear goals, professional development, telecommunication services assessment, sufficient budget, and an evaluation process. Although the technology plan framework mentions using a district committee to (a) develop, (b) examine, and (c) approve district technology plans, the amount of

participation and commitment are left to the districts. This implies that local leadership will apply a framework based on leadership's assumptions and beliefs of the importance of the technology plans.

Hoffman, (2002) in a study of technology planning in Michigan points out: The districts that scored highly in leadership were also among those well known in the state for their technology programs, suggesting non-statistical, real world support for the differences revealed by these case investigations. Although the tests could not establish casual connections between leadership and technology programs, these results minimally suggested that leadership is a requisite factor in successful programs (p. 160).

Armstrong (2000) studied the influence of leadership on technology adoption in Michigan schools. He surveyed 251 of the 524 school superintendents in Michigan schools. Findings indicated 209 of superintendents surveyed were members of the district's technology planning team. The majority of superintendents (89.2%) reported participating in-district training and in-services. Interestingly, Armstrong found that "Administrators were involved in decision making regarding selection and implementation more often in school districts with full-time technology directors than in school districts with part-time directors" (p.100). Armstrong also found that superintendents' perceived being included in the collaboration process of technology planning as significant. The importance of leadership modeling is supported by leadership literature to be a highly correlated characteristic defining effective leadership (Kouzes & Posner, 2002; Collins, 2001; Waters, Marzano, & McNulty, 2003).

Expanding Leadership Capacity
with a Technology Planning Committee

Superintendents can expand leadership capacity in schools with a technology planning committee. The superintendent's role, as facilitator and communicator, encourages committee members to take leadership roles in the organization, which builds the organizational leadership capacity in the system, which is important to systematic organizational change (Hall and Hord, 2006).

Careful selection of 8 to 10 committed team members is recommended by *Effective Schools'* research for school improvement committees (Lezotte & Jacoby, 1997). Carter & Cunningham (1997), cite Richard Miller, director emeritus of the American Association of School Administrator

Strategic plans for improving the school district should have the participation and input from those working within the system and the community before being adopted. Then regardless of what happens related to changes of board members or changes in the bureaucracy, you have a plan that's driving the district (p. 78).

Stakeholders may ask "Committee management – for what?" Assumptions that individuals hold as fact can be roadblocks to learning (Argyris, 1993). Instructional leaders looking for high quality decisions can process stakeholder viewpoints in committee. The central reason for coming together as a committee is to provide input data for shared belief action. A caveat for instructional leaders:

The degree of committee accomplishment depends directly on the extent to which many of the mechanical details of meeting arrangements are properly managed. If these details are handled well, the chances are enhanced that the meeting and the committee process will go smoothly. If they are handled poorly, they become at best an irritant to members and at worst an obstruction to committee action (Tropman, Johnson and Tropman, 1992, p. 65).

Distributed Leadership Theory
and Technology Planning

Distributed leadership theory, as a strategy for change, can be a powerful, dynamic for consensus and community building. In a practical sense, distributed leadership engages many people in leadership activity by including them in problem-solving and decision-making processes. Harris (2005) elaborates how power emerges in distributed leadership strategies through (a) descriptive power, which gives communities of learning identity, (b) representational power, which gives greater ownership in organizational change, and (c) normative power, which sets new norms and values. Distributed leadership challenges the tacit assumption of a single leader with followers and replaces it with leadership partnerships within system. The notion of increasing capacity in leadership with distributed leadership may have an inherent weakness, if the individuals lack confidence to assume the role (MacBeath, 2005). In practice, the superintendent needs political skills in team building to get the right people in the right places. Finding people capable and willing to assume leadership roles in the system is essential to sustained change. The increased leadership capacity in the system can sustain change, even if superintendent change occurs.

Hoffman (2000) concluded when instructional staff was included in technology planning; their technology plan had a higher degree of focus on curricular contexts. The technology committee may be a sub-group of the school improvement process, which examines technology use. The technology plan members may be voluntary representatives from a cross-section of stakeholders including technology leaders in the

school, librarians, grade level teachers, core subject teachers, teacher's union members, administrators, board members and parents.

Building a Shared Technology Vision

The superintendent leading technology change efforts must understand the need for a shared vision of future possibilities for technology in schools. By first understanding where the district is in terms of technology use, team members may reflect on their practice with technology. The vision of where we are compared to the vision of where we want to go builds needs around shared goals and objectives.

The burden of building a profile may seem a low priority in the busy days of an educator or administrator, but data is readily available in the course of daily duties. Input creates new information, which allows new ideas to develop. Conducting inventories of hardware, software, networking, human and financial resources in the district with inclusion of all staff members helps detail the profile.

The technology plan needs to be surfaced, so everyone has an opportunity to be involved. Consensus building means inquiry and advocacy, debate and collaboration. Revisions are agreed upon and shared visions stored in memory as a mental model of the organization, governed by shared norms and values (Kim, 1993).

Vision statements and technology profiles in the district's technology plan are artifacts of organizational beliefs. They constitute espoused theories for organizational behavior. Actions related to the espoused theories contained in a technology plan are observable. With all this said, technology plans are developed, implemented, evaluated

in various degrees within contexts. Even through a plan is developed, it may not be used. Espoused theories, as pointed out by Argyris and Norman, may not manifest themselves in theories-of-use.

To illustrate the inter-relatedness of the superintendents roles, as they work on instruction, political concerns may affect school management Battle (2004). “In other words superintendents are skeptical when integrating technology into curricula for fear of what a failed technology plan could mean to the socio-economic and/or socio-political stability of the superintendency” (p. 1).

Technology and Professional Development

A component and extension of technology planning is professional development. McKeachie (2006) notes that by fall of 2002, 99% of public schools had access to computers and 61% of U.S. households were connected to the internet. In the forward, Carter and Cunningham, (1997) comment that “Certainly, technology is one of the driving forces for change, but so are new constructivist, authentic approaches to learning; new assessment of quality performance; and new, dynamic career opportunities and worldviews.” Novak (1998) “It is not enough for individuals in an organization to learn, the organization as a whole must also be a learning organism” (p. 205).

The learning organization described by Senge (1990) offers pedagogy for professional development. McKeachie’s systems model (2006) of teaching with technology specifies four component parts that are interrelated: (a) instructors, (b) students, (c) technology, and (d) content.

The motivation to use technology as a teaching tool may be more appropriate if related directly to the teachers' subject area and interests. Therefore developing professional development activities with teachers must include the teacher practitioner. The success of leading a cultural or mental model change (Senge, 1990) comes in a large part from the perception of the instructional leader as honest and competent (Carter & Cunningham, 1997). A school leader, who is attempting to use instruction of teachers as a school improvement tool, must understand learners' perceptions, attitudes, and learning styles.

Jukes & Dosaj (2006) contend that some digital immigrants can't appreciate that digital natives have new skills and literacy needed to function in a new digital landscape. The profound shift needed to operate in a digital world needs to be taught to teachers, so they can guide students' skill development. Additionally, teacher training needs to provide a basic understanding of how learning actually does occur to in order to ensure that instructional practices are based on well researched solid theories of learning.

Dietrerle, Dede,& Schrier (2008) in their Neomillennial model suggest the importance of adding "media based learning" to traditional patterns of thinking and cognitive styles to accommodate the Digital Native learning style in addition to Sensory, personality, and aptitude models.

Some of these shifts are controversial for many faculty, and all involve 'unlearning' almost all unconscious beliefs, assumptions, and values about the nature of teaching, learning, and the academy. In addition to mastering the intellectual/technical dimensions involved, professional development that requires unlearning necessitates high levels of emotional/social support. As the nature of students alters, instructors must themselves experience mediated immersion and develop neomillennial learning styles to continue effective teaching" (p.1).

Fleming, N. D. & Mills, C. (1998) the VARK inventory is intended to help people understand their preferences for learning, and to help teachers teach to all types of learning styles. VARK stands for Visual, Aural, Read/write, and Kinesthetic styles of learning.

Myer-Briggs/Keirsey Temperament Sorter (extrovert/introvert, sensing/intuition, thinking/feeling, judging/perceiving). The Myers-Briggs is related to work by Carl Jung. Jung (1971) published theory that whichever function dominates consciousness its opposite function is repressed and will characterize unconscious behavior. The eight psychological types are categorized as 1) extraverted sensation, 2) introverted sensation, 3) extraverted intuition, 4) introverted intuition, 5) extraverted thinking , 6) introverted thinking, 7) extraverted feeling, and 8) introverted feeling. Myer-Briggs has 16 distinct, but interrelated, types. Most people lean toward one or the other of each of these pairs. There are 16 possible combinations of these four sets of traits. Understanding of personality types can smooth working relations with someone that you have previously had trouble getting along with, and even make it easier to understand a close friend or relative's choices.

Gardner's Multiple Intelligences identifies seven aptitudes 1) verbal-linguistic, 2) logical-mathematical, kinesthetic, 3) visual-spatial, 4) musical, 5) interpersonal, 6) intrapersonal, and 7) naturalist. Gardner's Theory of Multiple Intelligences has several implications for teachers in terms of classroom instruction. The theory states that all seven intelligences are needed to productively function in society. Teachers, therefore, should think of all intelligences as equally important. This is in great contrast to

traditional education systems which typically place a strong emphasis on the multiple development and use of verbal and mathematical intelligences. Thus, the Theory Multiple Intelligences implies that educators should recognize and teach to a broader range of talents and skills, which include Neo-Millennial (see Figure 2).

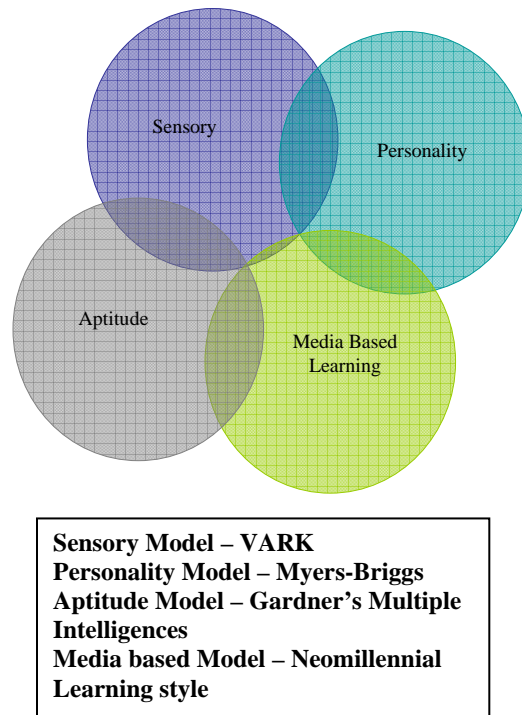


Figure 2. NeoMillennial Approach to Learning, Thinking & Cognitive Styles.

Expectations of Montana Superintendents

To understand the diverse nature of the superintendent’s role in Montana, a survey was given to Montana school board chairman to understand the expectations of Montana superintendents. Montana board chairman rated superintendents in 2000-2001 *School Leaders Survey* (SAELP, 2001) on preparation in several areas they expected

superintendents to be proficient. The areas of role responsibility in the survey are finances and budget, facilities planning and management, curriculum and instructional leadership, labor relations, legal issues, technology integration, community relations, and staff relations. The survey indicates the multi-faceted expectations of the role of Montana superintendents like those reflected in the literature.

Summary

The literature indicates that the political, instructional, and managerial roles of superintendents have been changed by electronic technology. As superintendents have lead the technology change in their schools, they have had adapted new approaches to their roles. Two national visions of educational reform, technology and student achievement, at first glance appear unrelated; however, technology has become a useful tool in the standards and accountability movement to improve student achievement and schools.

The importance of managing change in a time of reform has been essential to successful implementation of both technology and achievement visions. Superintendents have had to use inclusive processes in school improvement efforts. Technology has played a varied role in the change process. Electronic communication, information, and data processes have supported the superintendent's approaches.

From the reforms caused by legislative visions, superintendents have had experiences in the context of their practice. From contextual experiences, superintendents have developed assumptions and beliefs. These assumptions and beliefs

create a unique perspective about the efficacy of technology in student achievement and school improvement. The unique perspective is referred to by many as a mental model.

Mental model theory can have a number of utilities for superintendents managing inclusive change required by school improvement planning and technology planning. Besides understanding their own mental models, superintendents can better understand others. The collaboration and reflection of these multiple views creates new possibilities in schools. With a large breadth of learning theory, instructional practices can be tailored to reach all children to ensure their preparation for the future world-of-work. Before any technological model can be implemented, superintendents need to understand the relevant assumptions behind approaches. Research literature provides pieces of the technology integration puzzle, but practitioners offer a wealth of knowledge yet described and analyzed.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Introduction

Technology use in schools has received national attention, state attention and local attention as a promise of educational reform to improve schools and student performance. Technology and learning have become closely related (Sorensen & Murchu, 2006). In a self-reported technology survey of United States schools 87 % reported technology as integrated into their schools, and 13% considered their district behind the technology curve. Additionally, districts reported having significant plans for technology use in their schools in the future. Nearly 87% reported large technology initiatives for their districts. Ironically, the survey indicated that 40% of the districts anticipated spending “no money” on training and services. A staggering \$6 billion dollars was spent on educational related technology in 2005 (QED, 2005). Improving student achievement and schools with technology; however, doesn’t effectively occur without skilled leadership (Valdez, 2007).

Superintendent leadership roles in politics, instruction, and management have undergone unprecedented changes through the integration of technology. Technological approaches have been adopted for various reasons in various contexts. No research model existed to help superintendents learn approaches to integrate technology into their roles to improve schools and student achievement. Hansman (2001) explains, that contextual differences attributed to learning makes learning often situation specific. For

some superintendents, they may be uncertain about implementing technology to improve schools and achievement believing their knowledge of technology is inadequate (Valdez, 2007). To understand the approaches and assumptions guiding superintendent's actions, case study research of Montana superintendents with highly reputed reputations for technology was designed. Case study as an approach can provide contextual representations of thoughts and actions (Wolfe, 2001). Superintendents with highly regarded technology reputations can provide unique knowledge of technology approaches and reasoning used in their roles.

Case Study Design

To answer the questions of what assumptions Montana superintendents hold regarding technology integrated into their political, instructional, and managerial roles, grounded case study methodology was best suited to learning. Case study was an appropriate design because the study's focus was on unique phenomenon existing in a real-life context (Stake, 1995). Grounded case study methodology was used to systematically collect data and categorize themes as an analytical tool. A table of specification was developed to organize data sources. Tables of specifications were prepared for interviews of the superintendent, principals, and board chairman. Tables of specifications were during formal observations. The strategy was applied to multiple sources in order to gather data to describe technology approaches in the different schools in the district. Descriptions, stories, antidotal experiences, perceptions, and first hand knowledge allowed open coding of themes. This conceptual analysis was developed

from interviews, observations, and artifacts. Grounded methodology gave the case study a step-by-step approach.

The approach was tested in a pilot study prior to being implemented at the case study site. The tables of specifications required no adjustments; however, the scheduling, voice inflection, presence, and use of electronic devices for recording interviews improved with practice. The usefulness of themes in the pilot that emerged from data began to be more focused as multiple sources provided supporting data. The pilot began with fairly elaborate descriptions of technology approaches. Rewrites and revisiting data lead to interpretation. The balance of description and interpretation of the data resulted in reasoning of the superintendent for the technology approaches. This reasoning for technology approaches used by the superintendent resulted in emerging assumptions that created the mental models implemented as technology approaches in the superintendent's roles. The enlightenment from the pilot study helped improve interviewing abilities, observations skills, confidence, articulation of purpose of the research, and eventual descriptions, analysis, and reporting of findings. There were still unanswered questions regarding implications. Artifacts that provided rationale for technology in instruction were hypothetical; however, this did spur an interest that was later pursued in the case study. Yin (2003) the pilot case study is often used as logical methodology to refine the focus and improve the case study. Approximately 100 hours was committed to the pilot study including time at site, transcribing, and writing findings.

Descriptions of contexts were well described to provide a bounding of the research. Personal descriptions of the superintendents' background, education,

experiences, and technology expertise added a real-life to the study. Demographic descriptions allowed the reader to vicariously experience the space of the research including the community, the general facilities, classrooms, labs, and physical space in which the research was conducted.

Study interpretations were directed attention to the phenomenon that was examined within the scope of the research. Descriptions were balanced with interpretations. Case study methodology involved field work to collect data through interviews, observations, and artifacts over the course of a month. Fieldwork in this sense was more narrowly defined than qualitative ethnography, which gathers observation data over long periods of time in the field (Yin, 2003).

Researcher Perspective

Case study is a distinctive form of empirical study; nevertheless, lack of researcher rigor needs to be addressed (Yin, 2003). The researcher had an intense interest in technology and intrigue in efforts to coordinate standards, curriculum, and testing to improve schools and student achievement. The researcher had high respect for the superintendents, their schools, their staffs, and board chairman. It was considered an exceptional privilege to be allowed access to individuals, programs, visions, and practices. The researcher had a year experience as a superintendent and understood there was much to be learned. Furthermore, the trust given by the participants increased the learning and enlightenment with unprecedented access.

In order to report data fairly, several steps have been taken to minimize researcher bias in this case study. There were several sources of evidence collected from real life contexts. The data was recorded and transcripts were made for a data base. Key words, themes, and propositions emerged from a data base generated from multiple sources. The investigation was targeted with problem statements, research questions, and significance. This premeditated targeting controlled the abundance of data reducing the variability of emerging interests.

The case study followed a predetermined set of procedures. Selection of a jury for the purpose of selecting highly regarded technology superintendents guided the research to candidates. These procedures clearly outline the strategies of participant selection, evidence collection, and data analyses. No grandiose generalizations are made to populations or the universe, but analytic generalizations attempt to expand theory.

Identification of Jury

Three categorical sources were used to select candidate superintendents with highly regarded technology reputations for the case study: the Montana Office of Public Instruction, School Administrators of Montana (SAM), and region presidents of Montana Association School Superintendents, (MASS).

One source was OPI's technology specialist, Michael Hall. He works with Montana superintendents as the Office of Public Instruction's E-rate specialist, ESEA Title II Part D state level specialist, ESEA Title VI specialist. Michael Hall approves school technology plans for technology grants and federal technology spending in local

districts. His direct contact with local Montana school district technology visions, missions, goals, strategies, and budgets makes him a reputable source for identifying superintendents, who he considered, having a “highly regarded technology reputations.”

Executive Director Darrel Rudd, of School Administrators of Montana was used as another source to identify superintendents with “highly regarded technology reputations.” Darrel Rudd was a superintendent in Montana for several years. The organization, School Administrators of Montana, screens candidates for school districts hiring superintendents.

Finally, presidents of the nine administrative regions of the Montana Association of School Superintendents were canvassed for candidates. The presidents of each of these regions were contacted for suggestions of a superintendent they considered to have a “highly regarded reputation for technology.”

Jury Procedures

The sources were contacted by email to allow the sources to think and respond to the request, to refer superintendents with “highly regarded technology reputations.” The response turn-a-round was within a few days of the request from four. The five presidents not responding were contacted two weeks later. Lists from the three sources generated 10 superintendents, who were considered as having “highly regarded reputations for technology.” Superintendents, who appeared on multiple lists, were prioritized as candidates for this case study. One candidate was identified several times

from multiple sources, and was selected for the case study. There were other candidates less identified from multiple sources, one which was selected for the pilot case study.

Selection of Case Study Candidate

Selection sources identified several Montana superintendents with highly regarded reputations for technology. Three candidates appeared on multiple lists. Case studies are often used to describe unique cases of participants in natural settings (Gliner & Morgan, 2000; Stake, 1995).

In addition to recommendations, the candidates identified for a highly regarded technology reputations by multiple sources were screened. A screening criterion was applied to candidates to address other factors related to credibility. The criterion was valuable because it was assumed that these characteristics of participants would be vital to the most learning. The additional screening criteria requirements were (a) currently under contract and practicing as a K-12 Montana superintendent, (b) seven years of superintendent experience, (c) certified as a Montana superintendent, and (d) their schools were currently meeting AYP.

Pilot Case Study

One candidate with a highly regarded reputation for technology was selected for a pilot case study. Realizing that several visits would be needed to strengthen methodology for the case study, the pilot was primarily selected for proximity, access, and resources. The location allowed multiple visits providing a thorough investigation. The pilot case

study tested standard elements of the case study design including the research questions, protocol, interview questions, methodology of observations, and necessary artifacts.

The pilot case participant was selected with the same diligence, subject to the same criteria as the case study. Therefore, the pilot case had many intentional similarities to the case study. Because the units are not “sampling units,” the units have been selected purposefully. Patton (1990) “The logic and power of purposeful sampling derive from the emphasis on in-depth understanding” (p.46).

The pilot case study superintendent happened to be part of a qualitative research project along with five other school superintendents in qualitative coursework. Interview protocol, consent forms, reflective data checks, were all part of the class work procedures.

The pilot case study superintendent was contacted by email rather than phone to allow the candidate time to think about the request, discuss it with staff, and trustees. Two days later the superintendent agreed to commit some time to the study in a return email. In a return response email, the superintendent was briefed on a January timeline. Additionally, the superintendent was asked for an appointment in order to explain the research questions, purpose, and design. The pilot case study can be read in (Appendix A).

Case Study

The research participant was a practicing Montana superintendent identified by several sources as having a highly regarded reputation for technology. School

administrators perceived with high reputations operates more skillfully than counterparts (Nestor-Baker & Hoy; 2000; Ruff & Shoho; 2002). This unique identifier makes the case unique.

Case Participant

The case study was about a Montana K-8 superintendent in an elementary school district in western Montana, who has an Ed. Doctorate and 25 years experience.

After three years of teaching in Billings, the superintendent's administrative experience began as a principal of a predominately Native American middle school in Western Montana in 1982. After four years, the district expanded his role to middle school principal, superintendent. The superintendent reflected,

“And I remember we were in a budget situation and the school board decided to eliminate much of the clerical staff that existed. So, I had no computer background and still to this day I used the Marine method of typing with two fingers. But I've done it for so long that I can type pretty fast. But I can remember learning to use a computer so I can build my own budgets and do my own correspondence, to do all the evaluations, on computer and I remember starting this Radio Shack TRS Tandy computer and using the Multiplan spreadsheet in my basement trying to learn how to use that so I could do my budgets with that.”

His following district assignment was as a superintendent in a somewhat isolated, mid-sized district in northwestern Montana. The superintendent recalled, “While I was [in this position] my experience with computer technology began to grow. I became more proficient at it, more comfortable with it, moving into the IBM PC platform.” For five years he promoted technology and used metal mines money to increase technology integration into the district. He recalled having community people who were against

getting computers into the schools. He said, "They thought it was a waste of money."

He implemented a vigorous public relations program to help them understand that the computers in the schools could also be used for adult education purposes. He identified a need for adult computer training. With the rationale,

"Well, we will increase your skills and your marketability as adults to get another job because, remember when I was [in this position] that was when the mine was shutting down and the price of metals had dropped so dramatically. So, we needed to retool and retrain, and once the adults found out that they could have access to these tools, that they could learn with these tools and the school would be offering adult ed. classes for us. That was a good idea."

From northwestern Montana, he moved to a larger district in south central Montana for six years. "I followed the same model of infusing technology into the school trying to put together some sort of unified plan district wide as to how we would use technology in an integrated way."

The superintendent has been in his current position in a K-8 district for nine years. The district had a reputation for technology. In fact, the superintendent said,

"It was during my time [in a previous position] that I've visited [this current district] many times. And I was able to get a handle on what they were doing with technology in the classroom and matter of fact I even brought some of my teachers who are currently here today, to [this district] to do in-services for our teachers there. It's amazing how it's come full circle."

The superintendent credits the district's two long-standing principals as key drivers of the district's technology integration. As the superintendent laughed, enjoying the district's success,

"Across the state, people have heard of [our district]. A great percentage of it has to do with technology because we are one of the leaders in the state. And no one person can take all the credit. It was a school board. It was the administration, and the teachers buying into it and people's willingness to investigate a better way and different way."

The superintendent described his district,

“From when people first lived out here, this was simply a rural area. Now, it’s a semi-Metropolitan area with the rapid increase of population, but the people have fostered a relationship to the school. [Our district] to a lot of people as I mentioned, the school was a small school when it started and now its continually grown over the last hundred years to the point where it's rather large by Montana school district standards. But that sense of connectedness to the community and to the people who have lived out here remains to this day.”

The superintendent covers the grounds in staccato. A purposeful walk from building to building with a digital camera in hand, planning a PowerPoint, he heads for the junior high to talk about construction boundaries and student access with the principal. They walk the playground and he points to construction landmarks. She counters with concern for her students and asks for a modification of access. He heads for the construction trailer to talk to the project supervisor to modify the access as the junior high school principal requested. Through the back door of building #1 he visits with the custodian and then heads back to the district office where four members of an architectural firm waits in the board room. He starts right in on the unrolled plans, pointing to a possible psychologist room. He wants the two technology coordinators to have separate offices. A plan on the easel is entitled, “Elementary Education and Safety Improvement Project”. He is emphatic that the computers get hot and wants air conditioning in the rooms. They talk about a room for nursing mothers. No one smiles, it is all business. One architect says, he will email contractual agreements for sub-contractors. They have a few words about the roadway easement along the school and student safety, as he exits into the district office. In his office he grabs a bottle of water from a dorm sized refrigerator and says he has another meeting off campus. He

seemingly disappears. The clerk and the secretary smile from their desks, while their computers keep running. Both of their phones ring in unison. A fleeting moment fades.

Participant District

The district exists as its own entity adjacent to one of Montana's largest city districts. The district is influenced by suburban growth into its historic rural demographic. While there is a disparity in income 12.3 of households have an average of less than 15,000, 66.4 households earn 30,000 or more. The population is 90% white, 3% American Indian, 3.3% Asian, 1.1% black, and 1.5 Hispanic. The largest percentage of the population, 35.9% is 20 to 44 years of age. In terms of education, 93% of the population has a high school diploma, while 26.6 have bachelor degrees.

Heading west on I-90, it is easiest to exit on the westerly off ramp. After crossing one of the largest cities in Montana, 65,000 people, past Wal-Mart and other large shopping complexes, a four way stop light controls the traffic of a two lane road that parallels the river on the south and newly built condos complexes on the north. Heading west out of the city only a few miles, a two lane paved road intersects not much larger than a driveway, but as a through road the traffic is heavy with SUV's. The feel of the country quickly erodes as traffic backs up and suburban neighborhoods with occasional planned accesses pour traffic past a brick complex of the district schools, which look like six individual school houses in architectural design.

One can hear the first outdoor bell ring. The traffic, counting 300 cars condensed on the two-lane, is dropping off kids to meet the final bells. The school crossing guard is

helped by the school crossing lights controlling walking students across the road walking out of the local neighborhoods. The cars back up. Ten to fifteen kids cross the road. The school has an off road parking area in front where a white male adult opens the door for their student, a black special needs girl. The student slings a backpack over her shoulder and walks hand-in-hand with the adult to the school door. A few minutes later the parent is back at his car heading into traffic at 8:15 AM. The newspapers are stacked up like a paper boy's route pick-up. A staff member comes out and picks up the stack from a specially designed brick delivery center.

When the 8:30 AM bell rings, the traffic thins and the country quietness returns. Looking across the school grounds, farm land is green in the early spring weather. The urban sprawl of new homes abuts the 43 acre district campus of three complexes. The administration is in the south eastern building #1, one of the brick school house facades, along with grades 3-5. The K-2 building #2 is separate to the west. The 6-8 middle school building #3 is additionally a separate building with a large lunchroom and gymnasium.

There is a construction company in the largest parking lot. The grounds are staked and heavy equipment is working the campus perimeter. A plane flies over in approach to the airport just to the west of the campus. There is an ongoing concern that the 3 megabit connection to the internet, which basically correlates to 2 T1's infrastructure for the district is at risk with school expansion work.

The K-2 complex, building #2, hosts 408 students. There is one principal. The seven kindergarten classes average 20 students each, staffed by 7 FTE (full time

equivalents) for 139 total students. The eight first grade classes average 19 students, staffed by 8 FTE for 149 total students. The six second grade classes average 20 students, staffed by 6 FTE for 120 total students. Test proficiencies in grade 3 were 83.2 in reading and 67.9 in math, in 4th grade 80.2 in reading and 69.2 in math, in 5th grade 80 in reading and 66.9 in math.

The 3-5 complex, building #1, hosts 417 students. There is one principal. The third grade classes average 23 students, staffed by 6 FTE for 141 total students. The fourth grade classes average 24 students, staffed by 6 FTE for 144 students. The fifth grade classes average 22 students, staffed by 6 FTE for 132 students.

The 6-8 complex, building #3, hosts 439 students. There is a principal and an assistant principal. The sixth grade classes average 26 students, staffed by 6 FTE for 155 total students. The seventh grade classes average 23 students, staffed by 6 FTE for 137 students. The eighth grade classes average 24 students, staffed by 6 FTE for 147 students. Test proficiencies for grade 6 were 89.4 in reading and 63.4 in math, for grade 7 were 90.5 in reading and 81.1 in math and for grade 8 were 94 in reading and 81.4 in math.

There are certified counselors and librarians in each complex. There are two special education teachers in each complex totaling 6 FTE. With music, foreign language, title I, physical education, technology, art, keyboarding, speech, psychologist, and occupational therapy, support staff totals 28. There are 24 para-professionals throughout the district, 8 food service employees, and 9 custodial staff. The district

employs 140 individuals. The district's per pupil expenditure is 6,889. The total district general fund budget is \$7,334,613.00.

The district is committed to the use of integrated technology K-8 for managerial and instructional uses. The political process generated a voted approval of a technology depreciation fund in 2005 of 100,000 per year. E-rate funding from National policy reimburses the district for 50% of their connectivity expense. The district classrooms have a combination of computer pods, Smart Boards, laptops, computer labs, and teacher networked desktop computers connected with an infrastructure serviced by two computer technicians, who also act as the district technology coordinators.

The district is committed to computerized testing three times a year for all students in grades 1 through 8 through MAP (Measures of Academic Progress) testing. The district test coordinators set up these protocols and administer the tests in a computer lab setting.

The district attendance, grades, lunch count, and state reporting data are computerized with Schoolmaster. The junior high school uses class scheduling features of the program. In addition locker assignment, honor roles, graduation lists, sports physicals, rotating lunch schedules, student phone numbers, and parent information are data base assessable. Teachers check emails as a daily routine for a daily reminder memo of tasks, assemblies, and deadlines.

The district is currently working on chapter by chapter assessments in classrooms using CPS units and Smart Board technology. The vision is to develop a real-time data source of student achievement, teacher development, and curriculum assessment. The

Superintendent said, “We've got a very diverse population, we have over 8000 people that live in our school district and less than in 65% of them don't even have students in school.”

Fieldwork Protocol

All arrangements for fieldwork were scheduled through the superintendent. During these conversations, the superintendent was informed of the research problem, purpose, and procedures. A table of specifications for methods and sources contributed to the organization of the initial field visit. Strategies for meeting these goals were determined with the superintendents. He was provided with a list requesting interview sources. The superintendent was informed of fieldwork protocol involving interviews, observations and necessary artifacts. He scheduled times for interviews of principals and the board chairman.

The superintendent notified their principals of observations of instruction required. The 3-5 principal chose instructional staff to be observed. The K-2 principal notified staff and allowed random observations over the course of a month. Access to staff, testing labs, libraries, and meetings was encouraged by the superintendent. This access allowed informal interviews and observations. Shadow observations of superintendent in practice were documented during spontaneous time frames during school visits.

Interviews

Interview data of multiple sources were employed as a data collection technique to derive an understanding of technology approaches used in the superintendent's roles. Stake (1995) "Much of what we can not observe ourselves has been or is being observed by others" (p.64). Gathering data from several organizational stakeholders provided unique perspectives of technology approaches used by the superintendent. Tables of specifications guided alignment of interviews and research.

The interviews focused on sources thought to be the most insightful into the research questions. Questions were prepared to provide data related to the research questions. Additional questions emerged that were asked during a informal reflection interviews. Initial questions were memorized to give the interview a conversational tone. Interview questions intended to give the researcher a picture of the scenes relating to the research questions. Additionally, questions required interpretations of events, actions, and future visions. All interviews were audio recorded for transcript preparation.

Interview data from multiple sources contributed to a data base of coded words, phrases, and concepts related to the propositions of the case study. Despite the need to pursue an objective reality, "reality is a state of mind whose validity and meaning are determined by the private worlds within which each of us lives (Sergiovanni, 1984, p. 278). A protocol was developed and followed for interviewing. The protocol involved reviews of data by those interviewed. The interview evidence was used as one source of data for analysis to understand the affects of technology on the superintendent's roles and the assumptions supporting the understanding.

Superintendent Interviews

The superintendent was interviewed about all three research questions. A table of specifications was prepared with questions (APPENDIX C). The superintendent's roles were the focus of the case study; therefore, the superintendent offered first-hand knowledge. The descriptions and interpretations of the interview questions were based on his unique perspectives. Interviews were conducted in the superintendent's district office. The district level perspective offered the "bigger" picture perspective. The assumptions supporting questions perspectives are only available from this source. The interviews were structured, guided by a Table of Specifications (APPENDIX C).

Principal Interviews

As part of the administrative team, principals directly report to the superintendent. As a building level leader, principals can provide perspectives of technology related to unique age level students. Principals have first hand experiences with technology approaches supported by the superintendent in the district, particularly with the technology approaches in their buildings. Principals evaluate staff integrating technology into instruction, they plan approaches with staff, and make requisitions for technology. Principals provided data to the study from close proximity.

Chairman of the School Board

The relationship of the school board chairman and the superintendent was close. The superintendent and chairman communicated often about school vision, concerns,

approaches, and problems. As the public liaison to the school, the board chairman has political responsibilities for school governance. Agendas, purchase orders, technology, and school improvement plans were but a few responsibilities associated with the chairman's role. This working relationship provided another perspective of technology approaches in development, implementation, and evaluation stages. The chairman's support of technology approaches yielded insight into assumptions supporting technology integration into the district.

Interview Protocol

At the beginning of each interview, the research purpose, questions, confidentiality, and rights of the participants were covered with participants. Each participant read and signed a human participants' consent form. Each participant was interviewed for approximately one hour from a set of structured questions. The interviews were recorded and later transcribed.

Observations

Guided by the "theory of practice" (Argyris, 1980) careful attention was applied to observations. Technology tasks were observed and recorded with an observation data collection tool (APPENDIX D). Observations from multiple sources were also captured in field notes. The review of field notes through reflection with sources expanded complexities and sensitivity to interpret the superintendent's actions. Sergiovanni suggests focusing the theory of practice in an integrative fashion, to emphasize increasing

understanding and improving practice, bound action toward some goals or series of goals, focus on unique aspects of educational or organizational analysis, objectively document actions with accurate observations, record cultural responses to what ought to be, and finally map reality as viewed from different contexts and as viewed by different actors (1984).

The data gathered through observational strategies contributed to a data base of coded words, phrases, and concepts related to the research questions of the case study.

Superintendent Observations

The superintendent observations intended to collect evidence for the research questions. The observations were made systematically by date, time, place, and task. The observations were then checked with the superintendent to gather elaborations and verification checks.

The superintendent, as the case study, was necessary to observe. Observation was the only way to gather first-hand data. The observations allowed data collection of routines that participants themselves may be unaware. Observations allowed patterns of actions to be recorded for further reflection and understanding. The dynamics of what is happening in the here and now were insightful. By observing superintendents working at their tasks, data was collected that wasn't discussed in interviews. Observations helped develop new perspectives of technology approaches.

Observations of the superintendent in practice gave the data connectivity to others, who were planning and implementing technology approaches. This allowed for

follow up observations of technology coordinators, test coordinators, counselors, librarians, and teachers. Multiple sources of observations added data to allow more accurate descriptions of technology approaches. Specific attention was given to settings, participants, interactions, and frequency. Along with formal observations, informal observations also provided insights. The observation data was coded in a data base and triangulated with interview data and artifacts.

Classroom Observations

The superintendent's tacit assumptions about technology use in instruction made classroom observations at several different grade levels visible. With the focus of technology on improving instruction and student achievement, classroom instruction reflected the district's technology vision and goals. Observing technology approaches allowed description to be made from direct sources. Observations varied in length, but most were entire class periods. Informal interviews following class observations were used as perception checks.

School Improvement Committee Observations

The superintendent led a school improvement meeting over the course of two school days. Observations of the process provided data regarding technology in planning stages and implementation stages. The superintendent video recorded the first day of the school improvement meeting and direct observation occurred during the second day. Research indicates superintendent participation in meetings involving technology use in

schools has a positive affect on technology integration into schools and more effective use of technology in content areas. A wide range of perceptions were collected during the inclusive process. Principals, trustees, teachers, and community members were involved observed interacting.

Technology Meetings Artifacts

Collection of the school improvement committee artifacts allowed data related to several areas of the curriculum. Artifacts involved technology visions and innovation of instructional methods. The school improvement meeting included electronic artifacts.

Emerging artifacts, such as those collected during school improvement meetings, offered clues to the superintendents' technology actions in his political, instructional, and managerial roles. The superintendent created artifacts with technology for the school improvement meeting participants. Artifacts were used as a framework for technology discussions. Artifacts contributed to a data base of coded words, phrases, and concepts related to the research questions of the case study.

Artifacts

Many of the artifacts of this study were electronic in nature including web pages and documents contained within the school's web site. The superintendent used technology in many ways to communicate information. These artifacts were readily available online.

Artifact Analysis

Artifacts were examined pertaining to the technology use. The artifacts were aligned with the superintendents' approaches in their political, instructional and managerial roles. Each artifact was examined in content analysis. Osgood (1959) outlined a systematic approach to content focusing on concentration in text. The frequency of words, phrases, and concept data was used to support emerging themes in analysis. Additionally, the content analysis of concentrated text allowed vivid descriptions. Concurrent, instrumental analysis broadened the content analysis to participant scaling satisfaction. The addition of scaling to frequency coding gave the data more depth and breadth. The subsequent descriptions from a combination of analysis presented more support for interpretations during report.

Analysis of Data

The process of analytic induction according to Denzin (1978, p. 192) needs to be systematic. Data collected from multiple sources about superintendents with highly regarded reputations for technology use in schools was coded with words, phrases, and concepts related to the case in tables. There was ongoing reflection of the data in relationship to emerging themes. Many descriptions emerged from multiple sources supporting themes from which inferences in the form of assumptions were made in the report. Patton (2002) "Even the most comprehensive report will have to omit a great detail of information collected by the evaluator" (p. 511). With descriptions and interpretations in the report, the focus of analysis remained guided by the research

questions. The implications were from this grounded methodology is case specific. Multivariate input makes implications theoretical. The descriptions, interpretations, and inferences make the implications “ring true.”

The Reader as an Extension of Analysis

The analysis of the research will be extended by the reader, who has similar contextual experiences and associated assumptions, which they believe represent their reality. This case study research has attempted to provide a glimpse into the reality of a superintendent purposefully selected. The readers’ associated experience to the case study provides a means to reflect on leadership practice at the level of the superintendent.

RIB Request

In preparation for this research I completed training to fulfill the obligation for: “Human Participant Protections: Education for Research Teams” from the National Institutes of Health (NIH).

In order to register this research with the Institutional Review Board, an exemption was requested. The research proposed had no risks to subjects in a public educational setting involving normal practices. The proposed research involved the use of educational tests, interviews, observation of public behavior and did not deal with sensitive material such as sexual behavior, criminal behavior, substance abuse, matters affecting subject’s employability, or matters which could lead to criminal or civil

litigation. All materials were collected were kept confidential. Approval for this case study research came from Montana State University's Institutional Review Board.

CHAPTER 4

THE CASE STUDY

Introduction

The purpose of this research was to understand the technology approaches and assumptions of a Montana superintendent with a highly regarded reputation for technology use in schools. By identifying and describing the technology models of this superintendent with a high reputation for technology in context, technology models could be learned by others to improve schools, increase student learning, besides providing new insights for school leadership programs.

Analysis revealed Dr. Gold, the case study superintendent, held a set of assumptions regarding technology premised on perceptions of efficiency, learning, and sustainability. By interviewing, observing, and analyzing artifacts regarding Dr. Gold's actions pertaining to technology use within the district, a broader understanding of the superintendent's approaches to integrate technology into his managerial, instructional, and political roles was learned.

By describing the technology approaches used by Dr. Gold, technology models can be learned by others. By identifying related assumptions to the technology approaches, insight into the beliefs the case study superintendent held about the technology approaches provided a rationale. Dr. Gold believed technology models were important to help others learn. The superintendent explained the importance of model

districts, “I was able to get a handle on what they were doing with technology in the classroom and matter of fact I even brought some of my teachers.”

This chapter seeks to answer these research questions: (1) What assumptions guide technology approaches in his managerial roles? (2) What assumptions guide technology approaches in his instructional roles? (3) What assumptions guide technology approaches in his political roles? By answering these questions, models and the inherent reasoning behind the technology approaches were learned.

Case Study Superintendent

The case study superintendent held a Doctorate in Educational Leadership. Throughout this 20 year career as a Montana superintendent, the case study superintendent has believed in the importance of technology as an effective tool to help him with his school responsibilities.

Dr. Gold integrated technology into his management role early in his career. He recounted initial experiences with technology by saying,

I remember starting this RadioShack Tandy computer and using the Multiplan spreadsheet in my basement trying to learn how to use that so I could do my budgets.” From his experience he realized that comfort with the operating system and software was important to productivity. He elaborated, “I became more proficient at it, more comfortable with it, moving into the IBM PC platform. I am not a Mac person, I don't have an anything against Macs or Apple's, but I learned how to use a PC (Superintendent, 2008, p. 3).

Dr. Gold worked to integrate technology into school management by learning new technology approaches to increase efficiency. As new technology became available to the superintendent, purposes evolved for technology use. He pointed out several uses of

technology, “I type my own letters, I do my own correspondence, I do all kinds of budgets, everything I do, I do myself on the computer.” The technology efficiencies he learned early in his career became part of his management style. Dr. Gold said, “I followed the same model of infusing technology into the school trying to put together some sort of unified plan district wide as to how we would use technology in an integrated way.”

While integrating technology into schools, he had to manage change. Dr. Gold explained, “An interesting situation was that we had community people who were against getting computers into the schools. They thought it was a waste of money.” The superintendent had to communicate technology approaches and the reasoning for the implementation to his school communities to gain support.

To help community members understand the importance he held for technology, he developed an adult education program in technology to help community members learn how to use the tools. In his own words,

We helped them understand that if we had these computers in the school, those computers could be used for adult education purposes. Well, we explained we could increase their skills and their marketability as adults to get another job because remember when I was in this district, that was when the mine was shutting down and the price of metals had dropped so dramatically. And we needed to retool and retrain, and once the adults found out that they could have access to these tools, and that they could learn with these tools, and that the school would be offering adult education classes for them. It was a good idea to have that (Superintendent, 2008, p. 3).

He realized early that comfort with technology was essential for successful integration.

He identified technology oriented districts and used them as models. Professional

development approaches for teachers included visitations to these model districts to enable teachers to learn.

In his current district, Dr. Gold had to manage the accountability demands of NCLB and the district's technology expectations. He applied tools of technology to help manage student achievement. The superintendent was excited and actively pursuing the possibilities for real-time assessment protocols as a management framework within the district. Such protocols facilitate, pin point learning and the identification of instructional disparities. He was very serious about NCLB targets and the effects of failure. He questioned the value of NCLB testing practices to improve student achievement. He cited that the NCLB assessment tested students late in the year and reported after students transitioned to the next grade level. Such a practice thwarted possibilities for intervention for Dr. Gold. On the other hand, the real-time protocol for formative assessments chapter-by-chapter allowed him to implement instructional strategies to help students' developmental learning. The use of technology enabled teachers to see data to improve instructional effectiveness. The use of technology allowed data to be collected immediately. The efficiency of time saved correcting tests with technology, enabled teachers more time to plan interventions for students in need of improvement.

The use of technology to manage student achievement was consistent with Dr. Gold's philosophical belief that technology interested students and could be used as a tool to collect student achievement data. Table 1 reveals a high word count in the managerial role of assessment and student learning.

Specific words about technology that recurred in interviews indicated concepts that were predominately on his mind. The results of a word count from an interview indicated an emphasis of emerging themes related to technology. Word count indicated the relative strength of thoughts that occurred most often regarding technology to the superintendent (see tables,1, 2,& 3). Such repetitions of the same network of ideas underlie patterns of assumption according to Ruff & Shoho, (2005).

Table 1. Emerging Management Themes from Superintendent Interview.

Emerging Themes	Frequency of Words
Assessment and Student Learning	1,771
Enabling	876
Use of Technology	835
Technology Plan	702
Technology Budget	681
Digital Kids	661
Managing Change	589
Teacher Training	553
Technology Expectations	458
Sustainability of Comfort	416
Technology Experts	382
Vision	353
Technology Over Use	314
Efficiency	176

Alignment of instructional delivery with technology and the superintendent's belief of student learning complimented district technology values and expectations. The case superintendent often described technology approaches being used in instruction. He arranged several observations of classroom instruction with tools of technology.

Dr. Gold believed that students' immersion in a technological world had socialized them to technology. He believed that students were interested in technology because they used it outside of school. The superintendent shared values with members

of the school organization; two kindergarten teachers, two 5th grade teachers, three principals, a community member, and the board chairman agreed students were motivated to learn about and with technology. The shared assumptions of the value of technology for the purpose of motivating students had additional benefits for students. Dr. Gold was proud of the district technology lab where students took a mandatory technology class in the junior high to learn about computers, the internet, software, projectors, digital cameras, and printers. Students had technological opportunities instruction to access, sort, process, and use information. Learning these technological skills and abilities were important to the superintendent. He said technology money, “Right now, it’s spent on kids in the classrooms on instruction.” This student-centered instructional leadership style was reiterated when he talked about improving student achievement with technology. In the superintendent’s own words,

Yes, from my standpoint that's where I would like to go and again I don't get into the actual day-to-day situation as you a teacher. You can come up with whatever instructional models you want to come up with, but the end result is I want the kids to achieve. I want the kids to succeed. We believe here at [our school] that if in fact we utilize the tools of technology and tap in where they kids live today in terms of their abilities to understand and comprehend and utilize information, technology is indispensable for us (Superintendent, 2008, p. 2)

The superintendent worked to align the belief that students’ preferences learning with technology; therefore, technology it was important to infuse technology into instruction. Superintendent transitioned teachers through the change process with professional development approaches. Dr. Gold said, “It's great for our teachers that they've bought into technology assessments.”

Dr. Gold used several professional development approaches to help teachers become comfortable integrating technology tools into instruction. Dr. Gold gave an antidotal explanation,

Try it [a technological approach], if it works that's great, let's share with our colleagues. If it didn't work, that's fine, but share it with our colleagues and see if we can get some information how to make it better so it will work. So, you see professional development is a hallmark for us (Superintendent, 2008, p. 5).

The word “recalcitrant” was used by the superintendent. The junior high principal referred to herself as recalcitrant about infusing technology in math instruction with the assumption it would not work, but after experiencing how Smart Boards were “skillfully” used in math she held new assumptions of importance. The word count in Table 2 identifies themes emerging from the interview data with the superintendent about instruction.

Table 2. Emerging Instruction Themes from the Superintendent Interview.

Emerging Themes	Frequency of Words
Technology as Instructional Delivery Tool	670
Student learning preferences	421
Technology expectations	205
Efficiency in Instruction	184
Inclusion	114
Time on Task	113

The words of the chairman held an underlying assumption of the importance of technology in the district, when he said, “If technology was strong in the school, then the students were strong in technology. If the technology wasn't, students would have to catch up. They will not reach their potential, without technology. Not the world we live in today.”

The superintendent was training his staff to deliver instruction infused with technology because he held an assumption that students were interested, motivated by technology and he could use that interest to improve achievement by teaching content in a preferred technological mode.

The board of trustees and school community placed high expectations on the superintendent to sustain the district's technology beliefs. Meeting and exceeding these expectations required resources and personal capital. Technology enhanced management and instructional systems required ongoing commitment of resources—resources generally beyond the level of state funding formulas. To garner this additional political support, the superintendent used several approaches to showcase the benefits of technology to students, district staff, parents and community members. To accomplish this, he used several out reach approaches that opened the doors to the district. He used newspaper, television, and web pages to communicate what students were accomplishing with technology. The superintendent related the internet approach,

It's important for us to have our people comfortable utilizing those tools and for us to put our public relations campaign for our bond issue on the Internet. Constituents probably got more information from the internet than the public meetings I had here at school. It was a wonderful thing to see. And again for us to pass a \$13 million bond issue was huge for us (Superintendent, 2008, p. 14).

As a result, district student enrollment increased state formula support from families moving to the district. Technology depreciation levies of \$100 K per year, as well as a \$13 Million school bond for a new facility construction included new technology infrastructure was overwhelming supported by taxpayers.

Adult education classes were offered in technology. He sent students to local rest homes to teach the elderly about computers. The school hosted robotics competitions. He used digital photography with Power Points at public meetings. His communication skills were powerful enough to help the district create a reputation for technology use which reached such international proportions that foreign countries sent constituents to witness the integration of technology into learning and instruction. Table 3 showed higher word counts in communication of technology values, community expectations, and need for political support, which was consistent with his actions.

Table 3 Emerging Political Themes from the Superintendent Interview.

Emerging Themes	Frequency of Words
Communication of Values	720
Political Pressures	330
Political Support	314
Collaboration	161
Role Expectations	145
Commitment to Vision	75
Finances	30
Process of Innovation	23

Alignment of Superintendent's Role Approaches and the District's Values

The board of trustees considered alignment of leadership important to sustain the district's technology values. Sustaining the district's value for integrated technology was an explicit mission for Dr. Gold when he accepted the position. The chairman of the board recounted how technology evolved to a district priority over the last 10 to 15 years,

Well, I'd have to go back a ways, probably to the late 90s. We're blessed that the district has always let the board members go to national conventions. Some school districts didn't like to because of the cost. Well, we were always fortunate enough to have a superintendent and the district taxpayers who allowed us to go.

We were always looking for something new. And that's where we ran into the smatterings of technology. We found that we were ahead of 80% of the schools in the nation. It is without a doubt one of the best things that we ever did. We were awarded a blue-ribbon school by the US Department of Education for our advances in technology.

Due to the administration for most, and the school board cajoling the rest of the folks, 'Look we need to get on board with this because we're going to get left behind.' At that time in the late 90s, the schools overseas were ahead of us in technology and technology learning. So we couldn't waste a lot of time. We had the opportunity to look for another superintendent. We looked for a superintendent who was technology oriented. One that was willing to step over that line a little bit farther than others. That is how [Dr. Gold] came on board. And it happened and it was the best thing that ever happened for the school (Chairman, 2008, p. 2).

The Dr. White, intermediate school principal, had been with the district since the inception of the technology integration and described the value by saying, "I don't think there's any wrong use of technology? It can be used for skill and drill. It can be used to broaden learning through web-based. The problem with technology is just a lack of awareness of what it can do." It was apparent that the district technology values existed prior to the case study superintendent's being hired. However, it was equally apparent that the superintendent reinforced and strengthened the shared value of technology in the district. This shared value set the context for connecting technology to student learning and leadership approaches taken by the superintendent. In the superintendent's own words, "The focus here is to deliver content, but technology isn't always used in a strict content delivery mode." In this expanded context, the superintendent modeled the technological approaches in his managerial, instructional, and political roles.

The superintendent's value for technological approaches appeared to be well aligned with the district's. Dr. White emphasized the importance of aligning leadership with the shared district technology vision, "The superintendent has to have a vision of

technology. To be an effective superintendent in a technological world, a global world, the superintendent has to have a vision of its [technology's] effectiveness to schools.”

The shared district technology values were assumptions of the importance as the school improvement group rewrote their district vision. From the field observation notes:

The superintendent was looking to the facilitator for some direction. Anxiously, the superintendent flipped his pen between his fingers on his left hand. In his tan tailored suite with a pink shirt and coordinated tie, neat, shaved and pressed was in stark contrast to the T-shirt worn by the university facilitator. The prior day the group wrote values and beliefs about learning on large sheets and the facilitator taped them on the walls. “Commitment to technology” was one of the eight values on multiple sheets. Use of technology and innovative instruction were two values of twelve another sheets.

The quiet was broken, when the superintendent prompted, “Technology is an innovative way to deliver learning to students.” A community member in the school improvement meeting broke the quiet, “We chose to live here because of the school and the technology. This is what we wanted our daughter to be part of.” Several heads nodded. The superintendent blushed and smiled (Anderson, 2008, p. 19).

The superintendent’s use of technology in this meeting reinforced shared technology values of technology use. Technology was integrated into the school improvement meeting modeled, not by the superintendent, but the secretary and teachers modeling use as well. From the field notes:

The superintendent used a laptop in the middle of the library with a PowerPoint open. Twenty-four participants including the principals, teachers from each grade, board members, and community members responded to the districts’ 2002 goals. A slide with Goal #1 appeared, “To be a center in the community for innovative and effective instruction.”

Dr. Gold suggested breaking down into groups to discuss the goals and come up with strategies to meet each goal. He joined a discussion table with a group of four teachers. After twenty minutes, each group shared their ideas. The district secretary moved to the superintendent’s laptop and began recording the list of innovative technology approaches in MS Word.

After a lunch, the facilitator typed on the laptop the evolving vision, “[The School] is a community of learners joined together in a welcoming and safe

environment, motivating, and inspiring students for their future..." The secretary took over the typing and increased the font for all to see.

The discussion turned to symbolizing the vision in a graphic. The group discussed how they could promote the vision on T-shirts. A group suggested a learning tree. A fourth grade teacher walked over to a computer in the library lab and searched for a graphic. She saved it to flash memory and handed it to the superintendent. The superintendent brought up the picture of a Joshua tree in a Word document on his laptop. A learning tree symbol was projected on the screen and with text wrap; the superintendent added words "Excellence - Everywhere, Every way, Everyday (Anderson, 2008, p. 21-22).

The superintendent credited others for a recently adopted plan to deploy Smart Boards, "The technology, Smart Board plan, was put together by, not only the superintendent, but teachers, principals, and the school board." Dr. Gold went on to say, "How we got our smart boards is a huge innovation and approach that we did. When started, I knew nothing about smart boards."

The board chairman was amazed at the current depth and breadth of instructional technology, "We always had it in the back of our mind it was easier to deliver learning to the kids with computers. At that time I could have never imagined what we would be doing now with computers." This demonstrates that Dr. Gold continued to strengthen shared technology values with technology through continued innovation.

The strength of shared values of technology penetrated the student culture of the district. During the school improvement meeting described above, a middle school student came into the library from Spanish class to use a computer in the lab. He was a little surprised at the large group meeting of teachers, principals, parents, classified staff, specialists, school board members, and the superintendent. He searched the internet for a baseball field diamond.

The middle school principal asked him about the assignment. The student explained he needed it to label the player positions in Spanish. The student printed the baseball diamond and was escorted out of the meeting room. The student's presence, as well as the student's assignment, embodied the district's shared values (Field notes, 2008, p. 27).

The value of technology in the district had grown an international reputation. The superintendent smiled and divulged,

Well, yes, just today the University of Montana contacted me about educators from Kurdistan, who are coming here on the 15th of May to look at technology in our schools, how [Our School] is utilizing technology to deliver instructional content to children. We have schools from across the state come here for visitations to see how we are doing things. We have companies who come into our schools want to use our computers as demonstration sites, so they can bring their clients. We have had that all the years since I've been here, not because I have been here, but the district's technology reputation (Superintendent, 2008, p. 8).

The Dr. White, intermediate school principal, understood the importance of alignment of the superintendent's leadership beliefs and assumptions about technology with the district's. He explained,

The school board had the vision for technology and the school board hired the superintendent because they wanted somebody who had an interest in technology. That is why the current superintendent was hired. The superintendent was given specific instructions to pass a technology levy and promote technology. It [the shared value for technology] is top-down, but it's also bottom-up (Intermediate School Principal, 2008, p. 3).

The associated problem with not having shared technology values was characterized by the Dr. White,

If they are all on the same page then it all works, if they all have the same vision, if they don't have the same vision, it doesn't. So if everybody's on the same page it works, if not it doesn't.

And that's when it all comes together and jives as a well oiled machine. But if your teachers look at one model, and superintendent has another model and the tech coordinator has another model, and the principal has another model, it is not going to fly (Intermediate School Principal, 2008, p. 14).

The principal went on and told a story about a previous superintendent being out of sync with the district's technology values. At a board meeting the previous superintendent wanted to send reserve money back to the state.

The board members all looked at the superintendent, and then they all looked at each other and they talked about it. There was some division. Several were trying to side with the superintendent, trying to be nice. It was a five-member board and the other three were just looking at him, and this one lady who very seldom ever said anything, but when she speaks everybody listens. And she raises her hand and finally the chair calls on her, her name was Donna, and she said, 'Let me understand this, maybe I'm a little confused. We have \$300,000 and we either vote for them or we vote for us. I vote for us. I want to use the money for technology, for our computers.'

The superintendent resigned within a month or two and we had a new superintendent, we had a new technology committee and we're on our way to being one of the top technology schools in the country. Just because a board member, three board members, had the guts to say, "This is our priority. This is our vision. It is as where we want to go (Intermediate School Principal, 2008, p. 4).

In summary there was an alignment between the superintendent's leadership approaches and the district's shared technology values. Clearly the district saw technology as a priority before the arrival of Dr. Gold. Yet as demonstrated in the field notes and the interviews with the superintendent, the intermediate school principal, and school board chairman, it is equally clear that Dr. Gold had strengthened the value for technology in the district through his philosophical beliefs, modeling of technology use, through encouragement of teachers to try technology tools in instruction, through his commitment to technology in professional development, and continued promotion of technological in public.

Efficiency in the District Management Underscored Technology Approaches

The superintendent's approach to his managerial role is linked directly to assumptions of efficiency in organizing and communicating information to improve and sustain effective district and school operations. He realized the magnitude of data that

had to be collected, accessed, interpreted, and disseminated in a NCLB environment to improve and efficiently operate the district. He worked to increase management capacity and promoted innovation among staff to meet to data management demands. He believed that increasing capacity in the district among a variety of stakeholders required real-time data and on-going communication. Dr. Gold believed that technology could meet such demands in an efficient, sustainable way.

As the superintendent looked at the district clerk and secretary using a management software system to administer the district's \$7M budget, he said,

Well, for an example in this office, in terms of payroll, accounts payable, accounts receivable, timecards, things of that nature, I don't know how we would do all of that by hand. From my standpoint with all the budgeting things that go on, my computer is invaluable to me (Superintendent, 2008, p. 11).

Student management software helped managed 1,200 students in the district. The middle school principal added, "We are using schoolmaster for report cards, attendance, office referrals, detentions, class scheduling, so it does a lot for us. Another piece of technology that we use for office referrals, major behaviors, is SWIS (School Wide Information System)."

From the field notes:

A very busy elementary secretary took a minute to answer some questions about the superintendent's view of technology. She didn't take off her telephone headset as she listed "grades, attendance, state reporting, lunch count," as uses of technology in an informal interview. With two teachers waiting a word document on her computer screen, and calls coming in, she indicated that the middle school secretary may give more details. Both her words and actions spoke to increased management capacity and the need for technology to handle the volume of communications efficiently.

The middle school secretary was welcoming. The interview with the principal was delayed by a parent meeting. In an informal interview, she said that there were four programs most important to her, "Schoolmaster, Microsoft

Outlook, Microsoft Word and Excel.” The efficiencies of Schoolmaster included class scheduling, locker combinations, home phone numbers, inventories, and keeping track of the rotating schedule. She used email to relay phone messages to teachers. She smiled and explained that the district had outgrown the voice mail system, so there was no voice mail. She also used email to remind teachers of tasks like assemblies, meetings, and deadlines. She displayed a daily memo composed in Microsoft Word. With Microsoft Excel she did grade lists, honor rolls, and kept track of sports physicals. Many of the functions were paperless, but the secretary underscored the paperless environment by explaining that it was harder for P.E. teachers to access computers, so she put print copies in their mailboxes (Field notes, 2008, p.14)

The technological management approaches used by the superintendent to manage student data and communication in the three schools efficiently required increased leadership capacity. The superintendent said,

I'm just talking about my little office here in terms of what we do with correspondents and keeping database records of people. You move out of my office and going to the principals' realm in working with all of their teachers and all of their students. There's student databanks and student tracking systems that they have... if we didn't have those technology tools to keep track of, I don't know if I have all the space I would need for the 3 x 5 cards to keep that information.

It's a lot easier for me to just send out a mail list e-mail to alert staff to various changes, to alert staff if we have situations that we need them to be aware of, making sure that they have at least been notified. In our first responders program that we're involved in if we have a lockdown situation on campus or an emergency situation, those technology tools are invaluable to us to get that information out immediately in situations of safety for our teachers or kids (Superintendent, 2008, p.11).

Technology approaches increased efficiency throughout the district's schools, which saved time increasing the value of the technological approaches. This compounded efficiency reduced managerial time-on-task for several employees. The superintendent looked for new technological possibilities to increase management efficiency. Principal White added, “We're moving towards more curriculum management with technology as well.” The district's technology plan was on the district webpage. There were content

standards for each grade level on web pages for teacher guidance. Dr. Gold increased management capacity with technology training. The superintendent said, “Also we have benchmarks for what we would like our teachers to know to help infuse technology into instruction.”

The technology plan listed curriculum objectives, goals, and strategies. Use of technology to publish curriculum expectations was a valuable approach for the superintendent because it had the efficiency of staff guidance. Principal White explained, “Yeah and technology allows you to get the data real-time. We have never been able to do that, technology is allowing us to do that. It's speeding up the process.”

Web pages included all curriculum guides with standards. The superintendent's web approach emphasized the importance of communication of the standards to all stakeholders. The efficiency of the approach to teachers throughout the district fulfilled the need to clarify curriculum objectives and goals. The superintendent held the assumption of value because technology reduced the time to clarify instructional objectives.

In summary, the superintendent believed technology approaches used in his management role increased efficiency in the district office, and in the school buildings. He made a point that the paper system of the past “was just so inefficient!” He believed that technology training increased management capacities, which lead to increased time savings. The value of efficiency was shared by staff.

The intermediate school principal was asked if the school could operate without technology,

It wouldn't be as effective, but we can. We can still take attendance; we can still write attendance on a piece of paper and take it to the office. It won't be fun! There'll be a lot of snarling. It'll be a lot of trouble; it will be like a swamp. But the nice thing about it from a standpoint as a principal, once we get the technology back, and the fun starts again.

That's what's happened to me. Been through the process for so long as an administrator that I have had situations where the teachers have come up to me and said why we have these computers? I'm getting tired of these computers. I want more money on my salary and I want to apply that money that we are spending on technology to my salary. About two weeks later a line was cut, and they didn't have their computers and then they wanted their computers back. And they never complained after that. So it gives you an appreciation of technology real fast (Intermediate School Principal, 2008, p. 16).

This indicated that the student management software also had a shared value because of its utility to increase efficiency.

Perceptions of Learning in a Digital Culture

By member checking, it was verified that the superintendent encouraged instructional delivery with technology because he held a philosophical belief that a number of children had developed sophisticated aptitudes with respect to digital environments, which had changed their preferred way to learn. This belief that a number of students prefer learning with technology was shared by the school counselor, "Those kids, with society the way it is with computer games and digital gadgets, are just enthralled with technology."

Dr. White, the intermediate school principal, explained technology infused into instruction by saying, "It's the bridge, it's the catalyst for student learning, the vehicle. It transcends the kinesthetic. It hits it all. With technology, it not only builds interest, it's

motivational, and it's inspiring. It allows kids to interface with their modalities, with their learning styles.”

The superintendent continued to talk about how technology helped motivate student learning,

I think technology does help them. I think it makes them feel a little more attuned to what's going on in the classroom. Some of them are more willing to engage in the academic program. Some of them are more willing to meet a teacher halfway. Does that work for all of our kids? Probably not, but for the vast majority, I think it does. And technology for us, is just one cog-in-the-wheel (Superintendent, 2008, p. 12).

A review of an artifact (Whitehead, B.M., Jensen, D.F.N., & Boschee, 2003) connected the belief that kids prefer learning with technology. Layton (2000) provided a philosophical base for the artifact, “The important realization in this process is that students of the 21st Century are different and do require different learning styles” (p.1).

Mira’s (2003) research established that visual images of mathematical concepts provided by technology enhanced students’ math achievement. Written in the district’s mathematics curriculum guides, “Students should receive a full range of technological tools because research indicated that students learn mathematics more deeply with appropriate technological approaches.” These curriculum guides were aligned with the superintendent’s belief that technology taps into student learning preferences acculturated from their digital environment. The middle school principal was a skeptic, “I’m surprised at Smart Boards’ effectiveness in math. I was probably one of the recalcitrant in thinking that our math instruction or program would be enhanced by technology, by the Smart Boards.”

The district language arts curriculum guides also aligned with the superintendent's beliefs to provide instruction in the students' preferred learning style.

From the field notes, the language arts guide in the technology plan read:

It is important to recognize that many of the learning targets listed under these standards will require significant access to technology by individual students or student work groups. The committee believes these standards can be achieved with a strong district commitment to a technological infrastructure including sufficient equipment, materials, and staffing; appropriate technical support, and a comprehensive, ongoing program of teacher training and staff development (Field notes, 2008, p. 40).

The counselor reinforced the superintendent's assumptions of learning, "If you just watch them [kids] with those little Computer Programmed Systems (CPS's), those kids look forward to that and they like it and it's nice the way those features can be set up for kids, who really struggle. They participate."

In the kindergarten room a pod of six computers lined a wall. The teacher's aide helped the children move from station to station. She grabbed the hand of a young boy who was misbehaving on his way to the computers. She knelt in front of him and asked if he wanted to work on the computers? He agreed to behave. He didn't want to miss his computer rotation. The kindergarten teacher said "It is part of their world. It is the way of the future." This demonstrated that the student had a desire to learn with the computer and that the computer pods appeared to be a special place for him.

In an informal interview of the superintendent, the talk of kindergarten students using computers arose. He commented that it will be 12 years before these students graduate. He held the belief that technology would be more predominate in the future and therefore more important to the students' future. Dr. Gold pointed out, "In our

technology plan we have benchmarks for technology at every grade level.” He went on to explain his commitment at all grade levels,

And in our preschool if you can believe it we're using technology for kids as young as 36 months of age. They're saying the Smart Board technology and that goes all the way up the grades. And I think you'll find based on what our people do here, which is phenomenal, that when our kids graduate from Hellgate elementary and go to the big sky high school, 98% of them if you talk to those folks over at big sky high school I think you would find uniformly that Hellgate elementary kids are pretty well prepared for the high school arena especially in the area of using tools of technology to enhance their understanding and comprehension (Superintendent, 2008, p. 5).

The superintendent believed that students would need to be proficient with technology in the future. This assumption supported the shared belief in the value of technology in instruction. The superintendent said,

Each school board with varying degrees of expertise and sophistication... But at every stop of the road for me, every school board that I have been associated with has 100% understood that the world is different from when they were kids. And that we needed to have some degree of technology in our school setting to be able to have our kids compete, not only locally, not only statewide, not only national, but internationally (Superintendent, 2008, p. 15).

The chairman agreed with the superintendent about the importance of technology learning to the success of students in the future, “Absolutely they need to be kept up with the rest of the world. At that time in the late 90’s, schools overseas were ahead of us in technology and technology learning.”

The intermediate school library was an indicator of the future with its automated card catalog. The librarian talked about shared resources, computer access, information on CD ROMs, and television. The superintendent outlined the requirement of middle school student to take a technology class.

Dr. Gold talked about a computer lab in the middle school to expose students to real-life skills geared toward their futures,

We do have a technology Lab classroom which is a class that all our middle school kids circulate through which they do all kinds of things far beyond just the basic word processing they are doing digital photography, digital painting, digital graphics, and we would set you up an opportunity to see that lab as well. And we are very proud of that. Matter of fact we like to say in this district that we don't have any sacred cows, but we have two what is the technology Lab and that is the class for middle school kids and the other is a practical applications class for middle school kids. They do business applications with our kids that they funnel through, they learn the basic typing, but also business applications of software so the comfortable when they leave us (Superintendent, 2008, p. 5).

Chairman gave an example of how technology will fit into students' futures,

If 20 years ago you walked into an auto shop for a regular tune up and saw the way they did things, then fast-forward to today and step into auto shop and watch them do it. You'd be floored at how far things have moved since 20 years ago! You'd be saying, what are you doing? Because it's all done by computer, the equipment that they're working on the automobiles with is so sophisticated, so far advanced. That's what we're talking about, training these kids to do things by using technology (Chairman, 2008, p. 6).

The superintendent was proud of the robotics program because it provided an opportunity for students to work with technology in a career context. His pride in the program underscored his instructional approach as aligned to the belief that students were interested and motivated by technology through living in a technological culture.

I do think it's an interesting thing that as an offshoot of our technology program is our robotics program that we have here. One of our parents volunteered to get robotics into our school and our fifth-grade teacher was very excited about it. We now pay the adviser. The robotics club competes in state competitions. And to see the kids who you would think oh well this kid is not an athlete or this kid is not that, granted they aren't, but they have an aptitude for technology. They have an aptitude for computers, they have an aptitude for putting together broad base thought processes to make robots work, and it's fascinating how that works! And we even host an open house for robotics. The NASA people were here, and robotics clubs from across the county came to [Our School] and we had a mini robotics competition right here at the school where kids utilized the technology to

put together these robots. We're getting to the point now where we have so many kids wanting to get into the robotics club that we have to limit the numbers because we just don't have the time to get to them (Superintendent, 2008, p. 6).

In summary, the superintendent held a mental model that today's students learn differently because of rapidly changing technological innovations in the environment. Students using these technology devices in many different facets of their lives have acquired interest in technology. As a result of technological interests, students have learned technological skills that often surpass that of adults. The superintendent used these technological influences- interests, skills, and knowledge- from the students' environment as a bridge to improve student achievement by using technology to deliver content across-the-curriculum throughout the K-8 grade levels. The superintendent said, "I think the beauty of [our school] is that we infuse technology into the culture of the school. It hasn't been a big mandate from the superintendent and beaten down on the principals or beaten down on the teachers; it is teachers who believe this works for our kids."

The shared belief that students would need technology skills and abilities in the future accounted for technology approaches the superintendent implemented in the schools. Students learned with technology, used technology in learning, and learned in a school culture that shared the belief that technology would be important to students in the future. The belief that technology was important to the futures of students was indicated when the superintendent referenced former Secretary of Education, Richard Riley. Dr. Gold said, "We believe it is our job to prepare kids, for jobs that haven't been created yet,

using technologies that haven't been created yet, to solve problems that we don't even know that our problems yet.”

Perceptions of the superintendent that students learn differently because of technology exposure in their environments and the anticipation of technology's importance in students' futures support assumptions of need to integrate technology into instruction and learning.

Narrowing the Technology Gap between Teachers and Students

It made sense to the superintendent to instruct kids in a technological learning environment that was tuned to the students' digital learning experiences outside school. In order to align learning philosophy with instruction, the superintendent needed teachers to develop technological skills and abilities in order to fulfill the instructional mission. The superintendent said, “It's important for us to have our people comfortable utilizing those tools. So you can see that professional development is a hallmark for us.”

The middle high school principal supported the superintendent's assumptions that kids have digital skills and abilities and even suggested a technology gap between their teachers and students, “Students probably know more about technology than most of their teachers.”

The superintendent believed that professional development in technology connected his philosophy of learning preference to the instruction that students received in the classroom. As he trained teachers, they became more comfortable using the tools

of technology in the classroom. The middle high principal talked about the importance of teachers becoming comfortable with technology,

As teachers become comfortable with how they can enhance instruction and do some of the sorting and assessment. We have some newbie's who are still learning how to use the equipment and then we've got some of the other end of the spectrum, and are using it willingly and easily and now have to be working with their content and figuring out how the delivery can enhance content learning seamlessly, putting it all together (Middle School Principal, 2008, p. 3).

A 4th grade teacher confirmed the concentrated effort by the superintendent to make teachers comfortable with technology use in instruction, "We receive in-service and plenty of other opportunity is available for technology training." A kindergarten teacher added about professional development, "A great amount of resources are put into training." The teacher went on to explain that teachers received Smart Board training over the course of a week. Teacher groups did half day training rotations. He explained that the training was practical. The training allowed teachers to apply the technology to their content. Furthermore, he reported that during training he learned how to differentiate instruction with technology to challenge the high achievers, pull up the low achievers and meet each student at their own level with differentiated instruction using technology.

The counselor talked about the superintendent's approaches to train staff to infuse technology into instruction,

I think that there are several people using technology to deliver content in an effective way and there are more that will begin using it as they become more comfortable through the training, as training options increase. The superintendent does a pretty amazing job of offering opportunities to go to training and to participate in a half day in-services, where subs come in for a grade level. This way, grade level teachers can talk about concerns and collaborate (Counselor, 2008, p. 3).

The superintendent believed that new teachers could bring new knowledge of technology into the system. So, in hiring, he searched for teachers who were aligned with the district's technology values. According to the Chairman, technology integration into the district motivated technology savvy teachers to apply for open positions,

We can choose the teachers that we want to employ because we'll have a waiting line from here to Missoula that want to teach here. A lot of it has to do with the technology, a lot of it has to do with the administration, a lot of it has to do with the district and the school board; it's a shared component. But, a lot of it has to do with technology because when they come out of school, they say this is cool! This is cool stuff! They're walking around with blackberries and all kinds of stuff.

But, we can pick and choose who we want to teach, to employ here. It's not to say that with the ones that we don't employ aren't good teachers, but we just are able to pick better fits for us. I think that's important (Chairman, 2008, p. 11).

In summary, the technology disparity between teachers and students appeared to be narrowing because of approaches the superintendent used 1) teachers received professional development in technology, and 2) young people coming into the teaching profession brought technology interests, skills, and knowledge. This was important to sustaining the district shared values. The superintendent believed that professional development in technology had to be a hallmark of the district to achieve and sustain the mission.

The superintendent noticed that kids brought new cultural technological knowledge and skills to school, knowledge and skills that set them apart from the older generations teaching them. Implementing the technology plan involved having an instructional staff which was well trained in current technologies and could infuse technology into instruction. The superintendent's assumption that kids had technology

interests, skills, and abilities prompted approaches to improve teacher's technology skills and abilities because of the need to align instruction with assumptions about student learning.

Technology Infused into Classroom Instruction

Dr. Gold held a strong belief that technology was an effective instructional tool to motivate student learning. The school improvement meeting highlighted the fact that content delivery with technology was a district priority. The superintendent commented,

It is the responsibility of the building principals to make sure that that technology actually is being infused. Some of our principals go as far to tell our teachers especially the non tenured teachers that I'm coming to observe you; I don't care what lesson you teach, but I want to see something of technology infused in that lesson. I want to see how you are utilizing the tools, not only to help you impart information, but to help a students utilize those tools to improve achievement. That is the cornerstone of what we do here (Superintendent, 2008, p. 4).

From the field notes,

She threw her white scarf over the right shoulder of her leather bombardier jacket, adjusted her leather helmet and walked to the front of class. She was a first year teacher. Her wide smile and enthusiasm spread through the fifth graders like the sun coming out. The students tried, but she would only answer to Amelia, Amelia Earhart. At 10:08 in the morning, the main lesson of coordinate planes was applied to maps and flight. Now, she was checking for understanding of a math lesson given earlier with CPS units.. The Smart Board in front of the class was clearly visible from anywhere in the room. The students were holding their remote CPS units in anticipation of the quiz. A problem appeared 25×4 on a screen large enough for everyone to see. The students chose an answer from the four choices, 2×50 appeared and the students made their choices with the CPS units, which were interfaced with the teacher's grade book.

Amelia directed, "Mental math!" and $69 + 31$ appeared on the Smart Board. The students chose their answer. The problems appeared and disappeared. "Put the CPS units away." A groan from the students followed.

It was 10:12 AM. She began a quick review by tapping the Smart Board twice. "Do they need a common denominator?" she asked. Two problems

appeared and the students pumped their hands into the air trying to be selected to answer. Amelia, a first year teacher, smiled at the cooperation of the class.

Looking at her webpage for May 1, 2008, the lessons included the Smart Board, CPS units, a PowerPoint, a digital crossword puzzle on the Smart Board for vocabulary, virtual calculators, and digital pictures on the Smart Board. Besides the daily lessons with time, subject, location and resources, the teacher had a monthly schedule. The assignment boards were created with Microsoft Excel and Word and saved as an HTML (Field Notes, 2008, p. 8-10).

The real-time assessment was integrated into the math instruction as a knowledge check by the teacher as part of her lesson plan. The superintendent's belief that real-time achievement data was important was shared with the teacher. The infusion of the Smart Board technology into the lesson stimulated the visual senses of the students. The teacher explained that she could have students come up to the Smart Board and interact with the technology with different colored markers. She shared the belief with the superintendent that technology motivated student learning. Her lesson plans revealed several approaches using technology in instruction, but they also revealed instructional planning with technology.

The superintendent believed that there were real advantages with CPS units for special needs students participating in instruction. Dr. Gold explained how anonymity helped motivate students to risk participation,

The teacher will know, but the kids won't necessarily have to know. And what we've found for our children who struggle, title I kids, special needs kids, they can stay there with their peers and they can actually be an active participant member in the classroom. That is huge for us! And that's huge for our kids! It's an offshoot of technology. If you look at it from a self-concept standpoint, it's a huge plus for us. Those kids feel like they're part of the group (Superintendent, 2008, p. 21).

From the Field notes in the other 5th grade class,

Wilbur Wright was teaching the other 5th grade class. The rolled collar of his white shirt was era appropriate under a brown wool five button vest. His grey wool slacks matched his tie, while his wire rimmed glasses winked under his tartan 'Quarter' cap.

At 1:06 PM, the 20 students were ready. Some sat with their legs folded beneath them in their seats. The students tried, but he would only answer to Mr. Wright. His likeness to the picture on the Smart Board was astounding. He began telling his story of flight in the first person. Pictures of people and planes appeared on the Smart Board as he told his story. Within minutes he had a newspaper article from *Westside News* on the Smart Board. He read the article, and then asked, "Are the facts accurate?" The students sat in pods of six students, which had one computer per pod. He handed each student a handout of the 1903 *Missoulian*. The instructions were to read and agree as a group, "What was not accurate in the article?" A word processed timeline was taped to the front classroom wall, entitled, "Wall of Time."

The discussions at the pods were varied from pensive to lively. Each group had questions. The computer at each group was employed as a strategy to verify information and answer questions for the students. Mr. Wright walked from group to group giving the lesson a real-life feel of the Wright brothers. The collaborative answers starting coming from the students with a student's story and the corrections needed to be accurate. The Smart Board changed pictures from the gliders at Kitty Hawk, to photos the Wright brothers, to a NASA website gallery, and finally an archived Western Union telegraph from Orville Wright describing the flight.

At 1:40 PM, Mr. Wright asked the students to go to his webpage and click on a link. The teacher directed the students to read the article on the webpage out loud in their group about the science of flight.

The teacher then walked around the room and handed out a math problem in the form of a "flight plan." The students were instructed to solve the problems and then apply the answers to the flight simulator during some free time.

It was noon hour when a group of two girls, a pilot and co-pilot took the project flight yoke controls wired to a laptop, as another group of two boys watched. The plane could be heard as the students' increased speed on take-off and decreased speed and leveled off on their cross-country flight. The altitude gave them different views of the ground. They collaborated on what needed to be done to reach their destination from their flight plans. They grimaced with a few close calls, and yelled, "More speed, pull it up! (Field notes, 2008, p. 3-5).

The description of instruction infused with technology demonstrates an extension of the superintendent's belief in the importance of technology in learning and instruction.

Several high quality graphics and photographs of the era engaged the students' visual senses. With the student attention high, instruction included reading an era newspaper reprint. The computer pod approach with students' collaborative learning included information synthesis and evaluation of accuracy. The computer pod approach allowed students to practice computer and internet skills. Technology was used as a tool to bridge history content area and reading practice. The use of technology was also used to introduce students to flight careers, which bridged math content. The observations from the field notes documented a shared belief that technology in instruction could increase learning motivation.

From the field notes from observations of the K-2 building:

The kindergarten class was divided into groups rotating between five different activity stations that included a writing station, block building, painting, letter drawing and a computer pod of six machines. It could be observed that these kindergarteners were adept at using a mouse. They would shoot hot dogs at a target by clicking their mouse. The game strategy kept the kids concentrated on their screens. The kindergarten students were also scrolling through menus as a way to solve problems. They were selecting buttons that linked doors to other screens. The real life pictures in the software were being moved by clicking and holding as a way to organize the screen. With headphones, the pod was quiet until a little laughing broke out and the hot dogs starting flying out of the cannon again. The kindergarten teacher said, "The kids are enthralled by the computers."

Another kindergarten class was working through number counting software, which was an associated grade standard related to NCLB. One student exclaimed, "Look at Latamore!"

Another student, "I can't find the star."

Other student, "Did you look in the eyes?"

A group of boys and girls cheer together, "Yeah! Yeah!"

They clap as they find the hidden "3" in the consecutive number game.

The teacher prepared the students for station rotation with a "finish up and move" adding circling hand gestures.

A student changing stations hurried to the computer pods and began to reset the computer counting game, but found himself in the school homepage. A teacher's aide monitoring the groups asked the student having the problem, "Did

you hit the 'back button' too many times? Click on the red button." The student, "I like this game." (Field notes, 2008, p. 36-37).

The superintendent's belief that students need to develop technology skills was evident from the observations. Students were developing technology skills: (1) managing a mouse, (2) making appropriate right and left mouse choices, (3) clicking and holding, (4) scrolling bars, (5) understanding links, and (6) using a computer keyboard. This indicates the superintendent's belief that very young people can learn and improve technology skills.

The chairman believed, "The fact that kids can work at their own pace on a computer. If you have five or six computers in a room and you've got kids being mentored by a teacher to oversee what's going on, the kids are able to learn at their own speed. I think that the instructor has a better view of what's going on."

Dr. White, intermediate school principal, commented on student learning with technology and its importance, "It's the catalyst for student learning, the vehicle. It transcends the kinesthetic. It hits at it all. With technology, it not only builds interest, it's motivational, it's inspiring, but it allows kids to interface with their modalities, with their learning styles."

In summary, support for infusing technology into lessons throughout grade levels reflected a shared belief with the superintendent about technology's importance in instruction and learning. The purpose of supporting technology infusion in the district appeared to have three primary perspectives: 1) it captured students' attention, 2) it motivated students, 3) it was a catalyst for learning, 4) it promoted inclusion, 5) it

allowed students to learn technology skills, and 6) it encouraged collaboration among students.

Dr. Gold had a broad perspective that students would need technology skills in the future, while believing that technology was an indispensable tool for instruction and learning.

Using Technology to go beyond *No Child Left Behind*

The superintendent believed that NCLB refocused educators on every student's learning. He believed he had to use technology to understand the achievement of disaggregated groups in the district in order to respond to the assumptions behind the law.

Dr. Gold gave his perspective of NCLB,

I'm not a big fan of No Child Left Behind, but there are some elements of No Child Left Behind that are beneficial. The assessment piece is a big part of it. Prior to this, historically, 20 to 25% of our kids didn't get the stuff, while 75% of our kids are doing great! Reading and math and language arts were doing fine, but we had this group of about 20% who historically failed, who didn't meet the necessary benchmarks. And that was just the way it was. No Child Left Behind just kind of refocused us a little bit (Superintendent, 2008, p. 10).

The punitive nature of NCLB forced the superintendent to develop approaches with his staff to increase student achievement of the chronic under-achievers. Dr. Gold said, "Now, we have to do something for that 20%."

This left several unanswered tactical questions for the superintendent, "What can we do to help the students who aren't getting the content? What can we do to really focus how we teach? How can we refocus the lesson's guided practice, checking for

understanding, checking for errors, monitoring progress of kids regularly, so we can help those kids?”

The superintendent believed alternative assessments with technology could help identify the under-achieving students. The superintendent said, “If we don't assess student achievement along the way, we could be in trouble because today with our kids, the stakes are high. So, we have initiated other assessment pieces using technology.”

The superintendent explained one assessment model:

They're called MAP tests, (Measurements of Academic Progress). An interesting thing about that is that they're all technology-based leveled tests that we give three times a year. It is for us, right now, the one technology assessment piece that we do right now to really pinpoint; it really helps us analyze strengths and academic concerns that our kids have (Superintendent, 2008, p. 8).

From the field notes of a MAPs testing session:

The second graders lined up at 8:45 AM and headed down the hall to a computer lab, 12 boys and 8 girls. The computer lab had 24 computers lining outside walls with two pods of four computers back to back. The test coordinator was prepared to proctor the MAP tests in language arts.

Each student sat at a computer with their names on the screens. The testing atmosphere was relaxed. A student asked, “How much time do we have?”

The test coordinator responded, “As much as you want. Now, you can start the literature test.” Some students put on head phones to block out noise.

The students began working on their 52 question assessment. Two older students came to the door and asked to finish a test they started earlier in the day. The test coordinator set them up at two empty stations and they began to work (Field notes, 2008, p. 6-7).

The superintendent had all students tested three times a year with MAP assessments. The counselor pointed out, “I think approaches that [the superintendent] has been taking has been effective. He looks at the data, he charts it, and he's has spreadsheets from past years.” In the superintendent's own words, “Assessment is tremendously important here.”

Reflection of MAP assessments didn't completely satisfy the superintendent's need for improved student achievement data; therefore, assessment models were rethought for the realities of what value the data provided.

The counselor went on to explain the dynamics of the superintendent's search for approaches that would provide more valuable data to improve student achievement.

The superintendent has big plans! He wants to make it bigger! I don't know if he talked to you about the REAP project (Real-time Assessment Protocol), which is going to expand on what we did with the pretests post test ideas utilizing Exam View, Smart boards and CPS units.

I think the plan is that some of the teachers are to come in during the summer and look for instance at their math textbook, and if it comes with a CD that is compatible they will create pretests and post tests on textbook chapters using CPS (Classroom Performance Systems) and Exam View. I think it's one of those things that once it's been established, once the teachers can save what they've created, they won't have to re-create it [the real time assessments] every year (Counselor, 2008, p. 2).

The superintendent said,

The next thing we're going to do is REAP. I call it real-time assessment protocol. It involves the CPS units. The program gives us immediate feedback on students because we can assess section by section, chapter by chapter in grade levels on any chapter of the book. Then we can know immediately whether our kids are getting that concept or not getting that concept.

The reason it's exciting for us is that our teachers don't have to reinvent the wheel. They don't have to take a lot of extra time at home trying to figure how to devise this question or questions. It's as simple as a mouse click. You call up the exam in Exam View, you format. You say I want some questions about numbers and sense dealing with mixed numbers, the addition of mixed numbers. And there's a whole plethora of questions you can choose from. You can say I want this one or I want that one. Those questions automatically flow to the CPS format. You can give that assessment to your kids using the remote control technology and the Smart Board. It's a huge efficiency, huge (Superintendent, 2008, p. 9).

The superintendent had purchased Smart boards and CPS units to pilot real-time assessment. During instruction teachers used the CPS units as a tool to check if the

students were learning the material. The CPS approach was motivational. The anonymity of the CPS units also increases student participation because students are first motivated to use the remote controls and secondly because the CPS units reduce risk for students struggling to answer correctly.

The Dr. White spoke about the on-going CPS and Smart Board assessment strategy and its importance, “In other words, we will be able to test in the classrooms with pretests and post tests and that data will be able to come right into the principals’ offices. And then I’ll be able to see how kids are doing on certain targets or I’ll be able to target certain kids.” He continued with a story about using the data collected by REAP pilot trials.

I’m working with a teacher. She teaches geometry and she was using this CPS and the Smart Board. She gave a pretest and a post test. She tried a set of strategies and we found them not to be working. So, I went in and gave her three or four more strategies and had her talk to another teacher.

Okay, so for some reason the kids were not getting what a parallelogram was. So then she tried another strategy, something suggested to her. She tried placing geometric figures squares, a rhombus and parallelograms in and around her room. The kids had to find the different figures; it was kind of like a treasure hunt. So the kids would have to go around and find the parallelogram. They don’t know that it’s parallelogram when they look at it, but then they have a piece of paper and among themselves agree as a group that it’s a parallelogram. So they have to convince each other that it’s a parallelogram, and why it’s a parallelogram. And then they have to convince the other groups. So once they have that group convinced then they have to convince another group. So you’re constantly reinforcing the concept of the parallelogram. My precept is that we teach others what we need to learn. So I want the kids in the class to teach others in the class the best they can the foundations of the principles of math because it’s going to reinforce the content.

So then the fun part is that we get to test again. See, with the CPS units it only takes a few seconds. Technology allows us to get the data real-time. We have never been able to do that. The technology is allowing us to do that; it’s speeding up the process of adjusting instruction to help students missing concepts (Intermediate School Principal, 2008, p. 9).

The superintendent believed that computer generated assessment data had a shared value for students, teachers, and district stakeholders. Dr. Gold said, “And what we're finding, our teachers, whether they liked the [NCLB] law or not, have bought into using the tools of technology that we have available to them to analyze, what kids are making it and what kids aren't.” The board chair kept the focus on testing when he commented, “How are you going to know if your students have learned if you don't test them?”

The search for new assessment approaches with technology demonstrates a constantly evolving mental model to respond to NCLB. The superintendent outlines the approach in which he assumes that most value for student achievement.

We want to catch that and remediate it in those areas so in the end our kids can be successful. And we can't do that unless we have the tools of technology, which help us do that. Not only will the tools be able to help us on the assessment part, but the tools are going to be able to help that teacher.

Okay, our kids are not getting that concept and I taught at a certain way, so now I'm going to go back and re-teach it and I'm going to teach it a different way. And I'm going to use technology tools to help me do that. Because what we try to do is talk to every one of our teachers. We want our teachers to teach, to assess, review and read re-teach if necessary. Those are the four key elements. If the tools of technology are helping us do that instead of waiting nine weeks to find out the problem.

So we utilize technology to drive our assessment programs, which drives are curriculum program, which then drives are instructional program (Superintendent, 2008, p. 9).

In summary, the superintendent was serious about meeting state achievement targets because of the high stakes environment of NCLB; however, he questioned the value of once a year MonCat II test data to improve student achievement because data generated from the tests were reported back to the district too late to adjust instruction for

students missing developmental content. He referred to the test as “a snap shot of that day.”

He believed that other technological models of assessments that provided timely data would be more pertinent to improving student achievement. He implemented a technological assessment, MAP's, to generate timely student achievement data which had utility 1) of increasing student awareness of their achievement, 2) of measuring student progress in content, 3) of gauging classroom instruction effectiveness, and 4) of placement of students into reading groups.

Dr. Gold believed innovative technology assessment approaches could increase effectiveness in instruction. He pilot tested technological formative assessments that provided real-time content data while instruction occurred which allowed leadership to adjust instruction to meet the student learning deficiencies.

The superintendent believed that the data generated from REAP assessments in the classroom provided valuable data to guide instruction. With the Smart Board, CPS technology and tests developed by teachers, the superintendent had a real-time data approach in which he said, “...teachers bought into”. Dr. Gold explained, “It does me a whole lot of more good, if I know in ‘real time’ that my sixth-graders don't know how to divide fractions.”

The superintendent believed that alternative assessment approaches using technology could improve student achievement. He believed these assessment approaches met the spirit of the NCLB law and had utility to increase student achievement by improving instruction with real-time data.

Dr. Gold felt NCLB criterion, that determined if a school was failing, based on assessment data in disaggregated groups could have a detrimental affect on the political support for schools. Publicizing a school as “failing” for a one or two percentage point miss of disaggregated state data targets risked loss of confidence in leadership and instruction which jeopardized public political support. The inferred assumption of unexpected consequences was that the NCLB law could actually under-mind he spirit of improving schools 1) by loss of funding support, 2) deflating staff, and 3) diverting precious time to rationalization of disaggregated AYP scores from improving instruction.

Sustainability of the Shared Vision and Associated Threats

The superintendent was aware of the associated threats to the district’s mission to infuse technology. Mr. Gold’s political approaches stabilized technology budgets which allowed him to accelerate implementation of technology plans. Dr. Gold recalled the initial funding of Smart Board technology, “Teachers came to me and said, Dr. Gold, we would like to write a grant to try to get Smart Boards into the school. All right, write you’re grant. We wrote the grant with the teachers and by golly if they were funded!”

With 450 computers and 16 laptops in the district, according to the technology coordinator, replacement costs would be around \$700,000.00. The superintendent understood this would be impossible in a single year and even a stretch over several years. Dr. Gold said,

We’re trying to follow a sustainable classroom technology model in which we equip each classroom with Smart Board devices and audio enhancement systems. We are currently modeling those right now, as well as classroom performance

systems, CPS remote control systems, where kids actually have their own remote control and when the teacher gives tests the kids can record the answers electronically. The answers are tabulated immediately (Superintendent, 2008, p. 1).

The Dr. White noted,

The perception of this district is that [multiple computers in the classroom] it is not sustainable. What I am finding as a principal is that it's a combination of all those technologies gives teachers the greatest flexibility. My teachers, who are using five to eight computers in the classroom, plus the smart board, plus the scanner, plus the flex camera have the greatest flexibility, but it is not sustainable, financially (Intermediate School Principal, 2008, p. 13).

The technology budget was \$231,400.00 for the 2006-2007 school year

(Appendix E). The superintendent realized this was a substantial sum to be absorbed by the general budget and caused concern to sustainability of the District's technology mission. When asked what the board considered their most important achievement, the superintendent answered,

I will guarantee you today that that the Technology Levy of \$100,000 would be what they would say they are the most proud of. They were able to convince, the public to support that, and again, understanding [Our District] we are a very conservative school district.

The Technology Levy has enabled them to do what they wanted to do and that was get that smart Board technology in every one of those classrooms and to get CPS units into every one of those classrooms, and ultimately get sound enhancement systems into a classroom's because we know it will help our kids maximize their opportunity for learning.

They would say getting that Technology Levy passed which put the technology funding for this district on firm ground which will allow us to have continuity in our program from year to year, and not worry about having to pick up scraps at the end of a budgetary cycle (Superintendent, 2008, p. 15-16).

The middle school principal explained the reality of funding and its importance, "The Technology Levy was huge! Without it, integration would be a 10 or 15 year plan or as we could afford them, instead of a three-year plan."

Another source of funding was the passage of a bond issue to expand the school facilities and technology infrastructure. The bond also provided resources to leverage funds for the instructional mission according to the superintendent,

And again, for us to pass a \$13 million bond issue was huge for us. I do whatever I can do to leverage whatever resources that I can leverage to get that stuff and because if they're going to ask for it, I'm going to find it. A CPS unit off the street you would pay \$2000 for a 32 remote-control set. Because we buy so many of them we pay about \$1500 for 32.

The advantage that we have is that we can buy two units and covers 64 which are three classrooms. Okay, it's a huge investment. We have 85 teachers and we have 60 classrooms (Superintendent, 2008, p. 16).

The superintendent reduced the associated threats to the District's shared vision of technology using several novel funding approaches, "Well, we were able to do technology upgrades in two years simply because we were able to be a little more creative with some general fund money, technology money, Medicaid monies."

The superintendent used several communication approaches to sustain technology approaches. He reflected, "I think that's a big key of what the board does, open-door, come on in see what we're doing." The board chairman added,

I don't know a soul who has come to the school and looked at our technology and said, 'hogwash'. They have come and they have looked and they bought into it. Now, other people are not going to come in and they might not buy into it. But those who come into the school, become our converts (Chairman, 2008, p. 8).

The superintendent's approach to communicate the technology values to gain support was apparent,

We use newspapers and radio. We try to use television stations. We've been very fortunate that we have gotten some very good publicity, especially when you're dealing with little kids. It was just a wonderful opportunity for kids to show what they were doing with technology, but what a wonderful opportunity for [the school] to showcase the students achievements (Superintendent, 2008, p. 2).

The threat of not having technology savvy teachers to deliver instruction with technology tools was averted in the district with the continued reinforcement of their reputation. The Dr. White emphasized the connection, “Sustainability, that’s a huge issue because if you don’t have people on the same page with the vision, you can’t sustain the vision.” The assumption of sustainability extended into technology savvy instructors. The associated threat of personnel was not a problem for the superintendent. The chairman commented, “When we have an opening, we have 40 applications!”

From the field notes,

The superintendent looked at the new addition plans with the architects, pointed to the computer labs in the plans and reminded them of the need to have air conditioning, “The middle school computer rooms do get hot.” He checked to make sure that the two technology coordinators had separate offices.

After visiting the computer tech in the K-2 building, boxes of computer parts, broken machines, software, cables, and stacks of mail came to mind. A little embarrassed about the mess, the tech coordinator’s phone rang and he was off to fix something else. In the middle school library, the other tech coordinator was checking the network connections, school cameras, and waiting for the next connection to fix (Field notes, 2008, p. 17).

The threat of losing internet connectivity was considered a huge threat to the superintendent. Hiring technology coordinators who had technical skills and also an understanding of the shared vision was crucial, “The only concern I have is people without an educational background.” This concern was shared by the Dr. White, who had previous experiences with former technology coordinators,

For me, the biggest deterrents to integrate technology oddly enough are the technology coordinators. The technology coordinator, who does not understand schools, who does not understand curriculum, who has no educational background, and mandates the technology for the school (Intermediate School Principal, 2008, p. 6).

When asked, “Do technology coordinators have that much power?” to the elementary School principal, she said, “Oh, yes they do! Yes, they have a lot of power, a lot of power.” She went on to talk about her past experiences with technology coordinators,

[The tech coordinator] decided that it wasn't important, kindergarten kids don't need computers. They're just little kids, it don't matter. Our old technology coordinator would fight with us everyday; tell us what we didn't need. Everyone would tell him something that we thought we'd want or need, he would tell us why we didn't need it or why it wasn't important or something.

Oh, yeah! And really there are very few people, very few people who know more than the tech. So they can pretty much plan what they want to do and have their own agenda. For the most part he pretty much does what he thinks (Elementary School Principal, 2008, p. 3).

Dr. White when asked about threats to technology integration said,

It's a difficult call for the superintendent. So our superintendent has a difficult situation. He has a principal down here trying to promote technology, but he's got a technology coordinator down here who wants to do his own thing. It's not going to work. I cannot tell you how many times that has happened.

The technology coordinator often tells a superintendent what they're going to do or not going to do. The technology coordinator makes the decision. They have their own assumptions of what's effective.

We had a technology director, who bought Knowledge Works. At that time, the technology coordinator purchased \$10,000 of content software and nobody used it and was basically forcing the teachers to use it. And nobody used it. It was a waste of money, time, it created friction between the staff and technology director, it created problems for me as an administrator because I'm trying to sell the technology program to the community and the community is looking back and saying you spend \$10,000 on a program that nobody's using. The technology coordinator had that kind of control (Intermediate School Principal, 2008, p. 7).

The superintendent believed it was important to directly participate in technology planning. He worked with the technology coordinators to develop the technology plan.

The lack of planning was an associated threat to technology sustainability in the

superintendent's mind because he believed that the technology planning spanned his managerial, instructional and political roles.

It doesn't do us a whole lot of good in our district to have a technology plan that says buy this and this and this, and have people do this and this and this, if we don't have management plans that actually match up to that in terms of what I buy and what training needs to go with it (Superintendent, 2008, p. 9).

Asked about technology plans and the technology committee, the answers were surprising. The middle school principal added, "Honestly? I don't know how it's developed. It is the technology coordinators and the superintendent who drive our technology plan."

When asked about developing a technology plan, the K-2 principal said, "I don't think we really have the technology committee."

Researcher: Who writes the technology plan then?

Principal: The superintendent does. And the tech coordinators.

Researcher: So they're kind of the core... and the principals give input.

Principal: Sometimes. It's really hard to know because the people in the committees don't really know what they want and they're not always the ones with the most knowledge.

Every time they think of something, they bring us in and they ask what we think about this, and ask, are there any problems with it. There's a program they're looking at right now, a testing program, and we've looked at it couple three times and given input into it. I mean we spent the whole day looking at that program and giving input into ways we thought we could develop it.

Yeah, the latest technological thing that they've done was all the time cards stuff being done electronically. We were all brought in and given a little in-service on how all that works, you know.

Granted we didn't know it was going to happen, I didn't really know anybody who's doing it, did you? [Looking at Dr. White] but I think it is because the clerk found something that she liked and it works good. It saves time because we don't have to go through and check timecards every month. So, it works for me. It saves time. So they're kind of the core... and the principles give input (Elementary School Principal, 2008, p. 3).

The principal White worried about dependence of the superintendent on the technology coordinators and planning the technology mission in the district,

The one thing that we did talk about a little bit is the technology coordinator, and [he] is a major gatekeeper to the success or the non-success. It is the technology coordinator or director whatever term you want a use for them, basically has control of how much technology is used or where the technology will go. That technology coordinator or director, who is not online with the vision of the superintendent, and is not online with the curriculum, there's been big problems! If his tech coordinator says, 'No, I'm not going to support this', and convinces him [the superintendent] that this is not a direction to take, then that direction will not be taken (Intermediate School Principal, 2008, p. 3).

From the field notes,

A fifth grade teacher opened what he called his library of lessons. It was a virtual file cabinet of lessons on topics, quizzes, and tests related to content standards. He talked about his advocacy for technology for the past 7 years. A problem for the teacher was a recent change to a new software program that cut off his access to the district data bases, where his lessons were stored. The technology coordinator wanted him to use the new software exclusively. This meant according to the teacher, that all the lesson files had to be re-authored into new formats to be saved on the new software data base. The teacher had been a mentor to new teachers who were also using his approaches. He was comfortable with the old approach (Field notes, 2008, p. 28).

The Dr. White had experience with misalignment of the technology mission and personnel,

And the tech coordinator is telling me as a principal what will work in that classroom and what won't. And I have somebody like my fifth grade teacher who is doing miracles in the classroom with technology, miracles! And he can't sustain this program! Tech coordinators need to develop the connectivity that we want (Intermediate School Principal, 2008, p. 14)

The superintendent held an assumption that served him well, the belief in the importance of face-to-face contact. The superintendent commented,

But I do have concerns, it [technology] has changed us for the good, but on the other hand I do have to make sure that I constantly remind myself to get out of this office and go make some actual face-to-face contact with staff, with

principals. It's pretty easy for me to get locked in here and use my computer to just send stuff out. We don't want to lose that personal touch either. We are a people business after all (Superintendent, 2008, p. 12).

From the field notes,

The fifth grade teacher explained how he sat down with the superintendent and showed him the lessons, quizzes and tests in his file cabinet on the district data base. The teacher explained the problem of the new software. The superintendent resolved the threat to technology infusion by understanding the teacher's experience. When talking to the technology coordinator, he explained how the superintendent directed him to re-rout the link to the fifth grade teacher's files (Field notes, 2008, p. 3).

The middle school principal explained the superintendent's face-to-face approaches that balanced the over use of technological efficiencies,

If somebody has a burning question they want to take to him, they can easily get his ear. And he's frequently in the buildings. He stops by teachers who want to have a conversation. He's very proactive in that way; always when he receives word, a visit, an e-mail, a comment, from a teacher or a group of teachers, who are disgruntled about equality of technology delivery (Middle School Principal, 2008, p. 6).

The superintendent took the approach to hire technology experts to minimize the threats to district's technology vision and mission. The superintendent recognized the importance of quality skills and abilities that experts provided,

I have two wonderful technology people who are just experts at sleuthing around and trying to find the best bang for the buck. In terms of replacing technology equipment, for example in our elementary school, some of our kids outside of the graphic things for their programs in reading and math for their pictures and diagrams and things, really don't need the newest state-of-the-art computers with all the bells and whistles. But a machine that actually will do what they need it to do.

The state-of-the-art brand-new machine may be in our technology Lab, where kids need that as their applications become more sophisticated, but some are just newer versions of others, but all of them fit the niche of the developmental levels of the kids. And in order to fund that we have to have technology people who are constantly on the lookout for, what does a third-grade need? What does the kid in the fourth grade need? What does the eighth grade

need? And they do a wonderful job and then they come to me, of course and say here's what we found here's what we need do we have the money? And it's my job to find that (Superintendent, 2008, p. 7).

The superintendent used another approach to minimize his dependency on the technology coordinators that the Dr. White appreciated,

“The superintendent has done a good job in the sense that he has gone out and collaborated with TEST and different organizations to try to piece together this program where we looked at CPS and we looked at Smart Boards. We are looking for combinations that worked. We're piloting and experimenting with those, just like the one that I just explained pre-testing and post test with CPS (Superintendent, 2008, p. 10).

The value of several sources of expertise solved the dependency problem of misaligned technology coordinators. Principal White confirmed, “The superintendent develops the technology plan.”

Dr. White reflected,

In the early days we had a committee and the committee would develop the technology plan. The superintendent would meet with a collection of teachers, and staff in the morning over breakfast maybe once a month. The superintendent would take that feedback and start feeding that into the technology committee and the technology committee would make recommendations (Intermediate School Principal, 2008, p. 5).

From the field notes,

The superintendent's beliefs of associated threats were indicated as he left for a meeting to discuss a wireless connection to backup the district hard wired infrastructure. Technology can not be sustained without electricity, network connectivity, or IT (instructional technology) support. He pointed to an airplane over-head and pointed toward the nearby airport. He talked about the probabilities of a plane disaster. Threats of terrorism since 9-11 had become commonplace in the news. In fact the bond issue recently passed funded a project entitled, *Elementary Education and Safety Improvement Project*. As the construction crews sealed off the areas and marked the infrastructure lines, the technology program functioned seamlessly (Field notes, 2008, p. 17).

The Dr. White rolled his eyes, thinking about the initial installation of the internet lines stretching from school to school,

The lines will be cut, you can guarantee that. They are very shallow when we put them in and it is only a matter of time before somebody rolls through them and cuts one of those lines. The ground will break and shatter and rumble and there will be a great gnashing of teeth. And the kids when the power goes off will lose their computers (Intermediate School Principal, 2008, p. 16).

In summary, the superintendent's mission was to sustain the technology values in the district. He understood the associated threats to sustaining the technology 1) to create funding mechanisms for technology, 2) to develop a staff skilled in using technological tools in instruction, 3) to plan for technology, 4) to anticipate infrastructure needs, and 5) to make sure IT support was skilled and aligned with district educational goals.

The superintendent realized the threats to sustaining the District's technology vision were real, so he used proactive planning approaches. His belief that he had to communicate with all constituents in the district reduced misalignment of mental models. He believed that over-use of technology was a threat and addressed the realization with face-to-face communication.

Summary of Findings

The superintendent's managerial, instructional, and political roles were influenced by the District's shared value of technology's integration. When asked, "What it would be like if he didn't have technology to manage the district?" Dr. Gold flatly said, "The efficiency of our operation would be if terribly compromised. We have effectiveness in terms of central office. We have effectiveness at the building level operations."

The superintendent shared the belief that students had technological skills and interests learned from their environment. He shared the belief that it was important to “tap into” these learning strengths in instruction because a number of students preferred learning with technology. The associated problem for the superintendent was that he had teachers, who were not prepared to use technology to deliver content. To narrow this gap between instruction and learning, he committed resources toward professional development in technology. He referred to this technology training as a “hallmark” of the district.

Technology was infused into instruction with different technologies. Board members incubated the Smart Board technology for a year before teachers used it in the classroom. The superintendent piloted sound enhancement technology in a few classrooms. Computer pods in elementary classrooms were successfully utilized in daily routines. The superintendent believed that integrated technology into instruction motivated students because they had interest in technology, but he also believed that the students would need technology skills in the future.

Questioning of effectiveness NCLB assessments to adjust instruction during the year to improve student achievement, lead to technology based assessment approaches. The superintendent held an assumption of the importance of real-time assessment data. He believed real-time data had the utility to help leadership adjust instruction to improve achievement. The newest pilot was developing formative assessments with Smart Board and CPS technology.

The superintendent shared the belief that technology needed a purpose. Principal White agreed that purpose for technology was important saying,

Benchmarks have to set up to show me over time that it [technology] was a worthwhile investment for the taxpayer and the school district to put up valuable resources to this part of the school program. If it is just for show or just a gadget or it looks nice that's not going to cut the mustard. If you've got a plan that'll actually show us that it will enhance student achievement then we'll go that direction (Intermediate School Principal, 2008, p. 9)

The superintendent held the assumption that political support was important to reduce threats to the shared technology values. He showcased student achievement. He used adult education as an approach to strengthen political support. The junior high principal responded,

I think the superintendent's effort to increase our adult education program, to have 60 or 65% of our adults who do not have children in the school district, they have access to our school, whether it's for exercise programs, or for the use of our computer lab, to learn digital camera work, or other uses of technology (Middle School Principal, 2008, p. 7).

The superintendent gave an antidotal story about the support parents give the school when students advocate technology approaches,

If it happens that you and I are both in the fourth grade classroom, say we're both fourth-grade teachers, and I see that you are utilizing something with technology that your kids are buying into, and it's exciting and invigorating, and kids are comprehending, I would the sit down and talk about how I can use it.

Another thing that drives expectations is kids. You know when we get into the Smart Board technology or like when we get into the computer technology, we strategically placed the initial shots of smart boards, like we did with computers, so that if we had kids coming in first grade going into the second grade, by golly, we better have some technology and that next grade (Superintendent, 2008, p. 8).

While observing the school improvement meeting, a parent raised her hand and offered

“We chose to live here because of the school and the technology. This is what we wanted

our daughter to be part of.” The superintendent deliberately included stakeholders as an approach to gain support. The superintendent and several teachers modeled technology use in the school improvement meeting. The superintendent’s modeling strengthened technology values of organization through the school improvement meeting approach. This resulted in wide-spread acceptance and respect in his community and beyond for approaches used with technology and its importance in learning and instruction.

The emerging themes (Table 4) provide data from thematic categories established during analysis. Assessment and student achievement word counts teased out included data supporting student interest and motivation in technology. When the superintendent talked about assessment he included statements about student interest and motivation. Dr. Gold said, “For example if we give a question on the Smart Board the child can work at it at their desk and then they plug in the answer using the remote control. The response is tabulated right to the child themselves. It's fascinating! Our kids love it!”

In summary, the superintendent held several assumptions of technology, which emerged from the data. Word counts indicated that technology influenced the superintendent roles in many different ways. Findings from the superintendent’s managerial, instructional, and political role approaches indicate infused technology into his roles supported by assumptions of effectiveness, efficiency, learning preferences influenced by technology in the environment, shared values and importance. He understood how the NCLB’s framework influenced his district, but believed that technology tools could be used to meet the demands while preparing students for a future

world integrated with technology. The superintendent said, “We need to figure out how we can use the tools and technology, so these kids can eventually make a living.”

Table 4. Summary of Findings.

Finding	Sources for Finding
The superintendent held the assumptions that technology had many purposes in his different roles	Interview with Superintendent Interview with Chairman Interview with Middle School Principal Interview with Intermediate Principal Interview with Elementary Principal Interview with Kindergarten teacher Observation of school improvement Observation of Instruction Curriculum Guide for Math and Language Arts
The superintendent’s value for technological approaches appeared to be well aligned with the district’s.	Interview with Superintendent Interview with Intermediate Principal Interview with Chairman of Board
The superintendent held an assumption that students needed technology skills for the future and for learning.	Interview with Superintendent Interview with Chairman Interview with Elementary Principal Observation of school improvement
The superintendent believed that instruction needed to be aligned with student interest and motivation of technology.	Interview with Superintendent Interview with Chairman Elementary Principal Kindergarten teacher Counselor Curriculum Guide for Math and Language Arts
The superintendent held an assumption that teachers needed training to align instruction with student interest and motivation of technology.	Interview with Superintendent Interview with Middle School Principal Interview with Intermediate Principal Interview with Elementary Principal Interview with Kindergarten teacher Interview with Counselor Sign up sheets for training
The superintendent held the assumption that students needed to be tested and results needed to be in real-time in order to monitor their learning progress and for instructional adjustment.	Interview with Superintendent Interview with Chairman of Board Interview with Intermediate Principal Interview with Counselor 5 th grade teacher
The superintendent believed that political support was gained by communicating the importance of technology to students’ learning.	Interview with Superintendent Interview with Chairman of Board Interview with Intermediate Principal Observation of school improvement
The superintendent held the assumption that sustainability of technology approaches needed technical supports.	Interview with Superintendent Observation of technology coordinators Interview with Intermediate Principal Elementary Principal

CHAPTER 5

FINDINGS, IMPLICATIONS, AND
RECOMMENDATIONS FOR FURTHER STUDY

The purpose of the research was to understand the assumptions supporting technology approaches used by a superintendent with a highly regarded reputation for technology. The superintendent, in this case, strived to implement the most effective, efficient, and sustainable technological approaches as possible in executing his various roles. Data from words and actions about technology approaches were used to construct mental models about emerging assumptions. Findings indicated that technological approaches were constructed by reasoning through a set of associated assumptions. The superintendent's technology approaches were strategies to improve school management through greater efficiency. This efficiency approach could also be seen in his instructional role through technology approaches weaved into instructional leadership that were implemented to align with assumptions about students' learning. Furthermore, to sustain efficiency and the alignment of instruction, the superintendent publicized the value of technology to stakeholders to increase their understanding and garner political support for continued resources needed to fund the infusion of technology.

A superintendent with a strong reputation for technology use was selected to facilitate an understanding of sound assumptions underlying decision making in the area of technology. The assumptions which emerged in each of the superintendent's approaches seemed to occur in clusters to support decision-making. Many researchers (Craig, 1967; Argyris, 1980; Norman, 1983; Senge, 1990) have concluded that humans

depend on mental representations of the world to design, implement, and monitor actions. Therefore using mental model theory to examine a superintendent's leadership in technology sets the stage for the advancement of school leadership research.

Questions that Framed the Research

With an abundance of evidence supporting the importance of leadership to integrating technology (Armstrong, 2000; Battle, 2004; Calhoun, 2004; Hoffman, 2001; Picciano, 2002), understanding mental models of a superintendent with a high reputation of technology provided a means to understand better understand the leadership approaches taken in each of three leadership roles. The three research questions focusing this study were (1) what assumptions guide technology approaches in managerial roles? (2) What assumptions guide technology approaches in instructional roles? (3) What assumptions guide technology approaches in political roles?

Mental Model Theory in Case Study Research

Single case study design provided the methods to focus on the contextual use of technology in the managerial, instructional, and political roles of a superintendent with a high reputation for technology. The research questions were structured with mental model theory in mind, which involved approaches, a sub-set of the mental model system of assumptions identified by Kim. Kim (1993) provided evidence that mental models were assumptions constructed into a) perceptions, b) goals, c) approaches, and d) tactics. These subsets of assumptions worked as a system to form the mental model. Ruff (2000)

found that mental models evolved with experience, which could be understood as a cycling process.

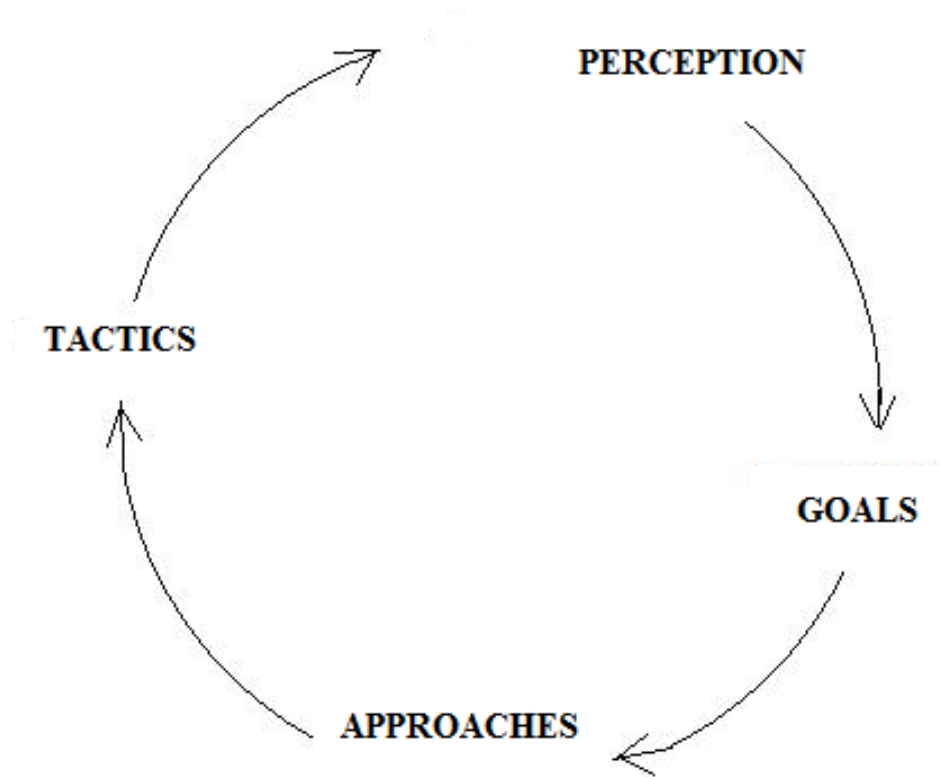


Figure 3. Cycling Process of Mental Models.

Senge (1990) suggested that mental models are developed for the purpose of human problem-solving. In this study, Dr. Gold, the superintendent, was using technology approaches to solve managerial, instructional and political problems. Assumptions of efficiency, effectiveness, and learning clustered to construct technology approaches supporting the superintendent's mental model.

Clusters of Assumptions as a Sub-set of
Mental Model Theory

The superintendent used clustered assumptions to make decisions about technology uses in his managerial role. For example, the superintendent's decision to use an email approach (see Table 5) to communicate with staff indicated an assumption cluster guiding decision making. Dr. Gold made the statement,

Just look at last night at our board meeting. Our board approved an early retirement incentive program. That information went out today. I didn't have to put it into slow mail where everybody would get it in a couple of days. It went out today to everybody's mailbox explaining what the program is. When you have only a short period of time to make decisions, you have the ability to get that information to them right off the bat. The efficiency of using those technology tools cannot be overstated for us, but the efficiency of communication and using technology is just invaluable to us (Superintendent, 2008, p. 12).

The superintendent had a purpose to communicate and had two possibilities slow mail or email. Cognitively, he created two clusters of assumptions in order to decide the best approach.

Table 5. Clusters of Assumptions from Management Decisions.

Slow mail – assumption clusters	E-mail – assumption clusters
Assumption of Possibility	Assumption of Possibility
Assumption of Ability – teacher have access to slow mail.	Assumption of Ability – teachers have access to e-mail.
Assumption of Acceptability of Approach	Assumption of Acceptability of Approach
Efficiency of Approach – Time was shortened for teacher making choices	Efficiency of Approach – Time was increased for those making choices.
Assumption of Cluster supporting decision point and Approach.	Assumption of Cluster support decision point and Approach
Choice was made not to use slow mail.	Choice made to use e-mail

The superintendent also relied on clustered assumptions in his instructional role. Several statements made regarding Smart Board technology implementation indicated assumptions supporting decisions to use technology in instruction were guided by assumption clusters. The superintendent's decision to implement Smart Board technology approaches indicated how the superintendent learned through assumptions of staff members, when limited his own experience was limited.

Dr. Gold said, "When we started, I knew nothing about smart boards." Without any knowledge of Smart Boards, the superintendent had to construct Smart Board technology assumptions to support a decision point (see Table 6). The superintendent decided, "Teachers come to me [saying] we want to write a grant to try to get Smart Boards into the school. All right, we wrote the grant with the teachers and by golly if they weren't funded." The superintendent's clustered assumptions of acceptance, assumptions of possibilities, and assumptions of value to support actions.

The superintendent's assumptions regarding Smart Board changed as tactics and technology planning evolved. Dr. Gold explained, "The next step after the equipment was now, we need some training. So we got to ask Total Educational Solutions Company to come in and provide some training." This indicated new assumptions of need based on assumptions to improve skills and abilities. The superintendent's statement,

The next step was dubbed my "now and see" what we're using this for. We piloted this in three or four classrooms in this entire district, alright fine I'll come down and I'm looking at this and going, wow, it has applications that far beyond anything that I can even comprehend. Virtually every one of our classrooms now at [School Name] has a smart board. P.1 (Superintendent, 2008 p. 17)

Table 6. Clustered Assumptions in Instructional Role Decision.

Assumptions accompanying Smart Boards	Data
Assumption of Possibility	brought to him by teachers
Assumption of Acceptance	teachers approaching him
Assumption of Need	Approval grant for Smart Board
Assumption of Skills and Abilities	Now, we need training.
Assumption of Value	aligns learning and instruction
Assumption of possibilities, acceptance, skills, abilities, and utility.	Superintendent decided to implement approach in limited classrooms
Confirms assumptions of value and increases assumptions of possibilities that every classroom needs Smart Boards.	successful pilot
Assumptions of Acceptance	Teachers accept Smart Boards, new possibilities for use
Assumptions of Skills and Abilities	more training needed
Assumption of Importance	district resources spent
Assumption of Value	purpose met to align student learning preference with instruction

The superintendent also seemed to use clustered assumptions in his approach to increase political support. The superintendent decided to ask for technology support through a depreciation fund. These decisions seem to be guided by a cluster of assumptions (see Table 7). For example, the following superintendent's statement revealed a clustered pattern of assumptions guiding decisions for support.

I will tell you right now, up until a couple years ago [our school] funded its technology with the end of the year leftovers, which was amazing to me because we have so much technology. We funded on a shoestring, hoping that we would have monies left over at the end of the year. And if we did have monies left over at the end of the year, we would go ahead and try to dedicate it to upgrading technology, but it got to the point here, where we have over 400 computers in our district.

So one of the things we were able to do was in my years here and everybody participated from the board to the principals, to the teachers to the kids, and PTA parents promoting this, was, we were able to pass that technology levy and \$100,000 is a lot of money for us to get in annually to strictly improve our technology program. That doesn't mean that we've only got that hundred

thousand dollars, we have our end of the year monies too. Now we still use those end of the year monies, but it is supplemented with another hundred thousand dollars on top of that (superintendent, 2008, p. 6).

The superintendent believed that increased funding would allow the district to improve its technology program. The superintendent communicated an assumption of need for increased funding while including assumptions of possibilities. Finally, a depreciation levy was considered best course of action.

Table 7. Assumption clusters from Superintendent’s Political Decision.

Assumptions of the Superintendent	Statements of Superintendent
Assumption of Need	We need to upgrade over 400 computers
Assumptions of Possibilities	400 computers to upgrade strained the budget
Assumptions of Acceptance	Everybody participated
Assumptions of Skills and Ability	We disseminated information for a vote
Assumptions of Efficiency	Depreciation funding and end of the year money will improve technology program.
Assumptions of Value	The passage of the depreciation fund would be valuable to the district technology program in the future.
Assumptions of Sustainability –	The passage of the depreciation fund would allow the district to sustain the technology in the future.
Assumptions of Realities	We still have end of the year money.
Open to new possibilities	Resources may be available.

In conclusion, several assumptions emerged to support technology approaches in the superintendent’s managerial, instructional and political roles. Perceived assumptions of need by necessity included assumptions of possibilities. The assumptions of possibilities enlarged the cluster of assumptions to assumptions of needs to accomplish possibilities. Assumptions of efficiency, importance, and value were also clustered by the superintendent in making judgments and decisions about technology use in

management, instruction, and political roles. Clustered assumptions were used by the superintendent at decision points as reference and for guidance to determine the best course of action. Clustering of assumptions is a new finding and advances mental model theory.

Implications of Assumptions of Student Learning

Assumptions that a saturated digital culture impacted children's learning were shared among the district's leadership team and the school board. The superintendent encouraged instructional delivery with technology because he held an assumption that children have developed sophisticated aptitudes with respect to digital environments, that this sophisticated digital aptitude changed the preferred way to students learn, and that instruction infused with technology could improve student achievement. Layton (2000) contended that students of the 21st century are different and required different learning models and this contention explains why educators are having a hard time in traditional learning environments today.

The implication of the assumption that there is a need to align student learning preferences with instruction created systemic needs that affected the superintendent's managerial, instructional, and political roles 1) management plans were tied to technology planning, 2) budgets had to be developed to purchase and service technology, 3) time and money were allocated for staff training to make staff comfortable with instructional technology, 4) district technology support staff was added, 5) infrastructure and facilities were upgraded, and 6) technology successes required publicity to garner

support. Concisely put, this assumption, about the need to align student learning preferences with instruction, aligned resources and support to a specific focus forming a clear vision among all stakeholders of the district. The superintendent said, “The hardest thing, and I don't care who you would talk to, is to help people improve their [teachers] skills. We must improve their confidence, so they can actually use the technology equipment. That is cornerstone of what we do here, professional development.”

The superintendent's assumptions that students were interested and motivated through learning with technology, that students have sophisticated aptitudes in digital environments, and that instruction infused with technology was a preferred way to learn, supported his infusion of several technological approaches into instruction. On the other hand, recalcitrant assumptions may be keeping others from infusing technology into instruction. Senge (1990) summed the problem up by saying, “New insights fail to get put into practice because they conflict with deeply held internal images of how the world works (p.174).

Implication of Assumption Clusters in Mental Models

The finding that assumptions seem clustered to support superintendent's approaches to his roles appears to advance mental model theory. Argyris (1980) reasoned mental models not only guide an individual's perception of the world, but also how individuals take action in the world. Kim (1993) identified approaches as a mental model sub-set. Senge (1990) advanced the notion that assumptions constructing mental models may conflict with assumptions of others and reflection and inquiry were needed

to understand how others came to their views. Clusters of assumptions seem to form an underlying structure of assumptions in approach and this idea is new or has not been previously discussed in research.

Bruner (1977) wrote that human understanding seeks to find patterns in events and structures in patterns. The finding that assumptions in the superintendent's approaches to his role seem to occur in clusters extends our understanding of mental models. Clustering of assumptions appear to be needed to progress toward an implementing an approach. This means mental models can be understood as a process of increasing strength as assumptions are added to support the approach. Assumptions have not been thought of as interrelated, yet this superintendent relied on the inter-relationship of assumptions to organize his own mental model. This allowed for categorizing assumptions to simplify understanding of the process of what needs to be done. Mental model development, therefore, appears to start with a core assumption and layers related assumptions. A look inside the leader's mental model reflects a system assumptions of agreement and constraint in categorized clusters of assumptions constructing the mental model of the superintendent.

The assumption clusters seem to be used as reference and guidance for the superintendent throughout the process of infusing technology into the district, changing as new assumptions cluster. Single assumption points may overlook significant other assumptions to the implementation of the approach creating an unanticipated error.

For leadership, clusters of assumptions provided depth and breadth of understanding prior to implementing approaches. Dr. Gold actively practiced improving

his mental model clusters by viewing the situation from multiple perspectives. The superintendent's mental model was constructed with clusters of all this input, which was effective implementing technology approaches.

Further Research

Patterns of assumptions creating the approach within the mental model system occur in clusters, and these clusters of assumptions may be hierarchical in nature; however, insufficient evidence was found in this study for such a conclusion. The superintendent used the word "next" several times during the implementation of Smart Boards. Dr. Gold explained, "The next step after the equipment was now, we need some training. So we got to Total Educational Solutions Company to come in and provide some training." These words imply the possibility that a progressive or hierarchal pattern of assumptions exist as one assumption cluster may be necessary before the next cluster is considered in the implementation of technology (see Figure 4).

The continual search for a better instructional assessment approach by the superintendent also may have been thought out in a hierarchical fashion. Dissatisfaction in data usefulness started a process of analyzing value by determining needs and possibilities to skills and abilities to effectiveness and value.

The mental model of the superintendent may have been a lineal progressing from needs and possibilities, to skills and abilities, to effectiveness and value of technology approaches.

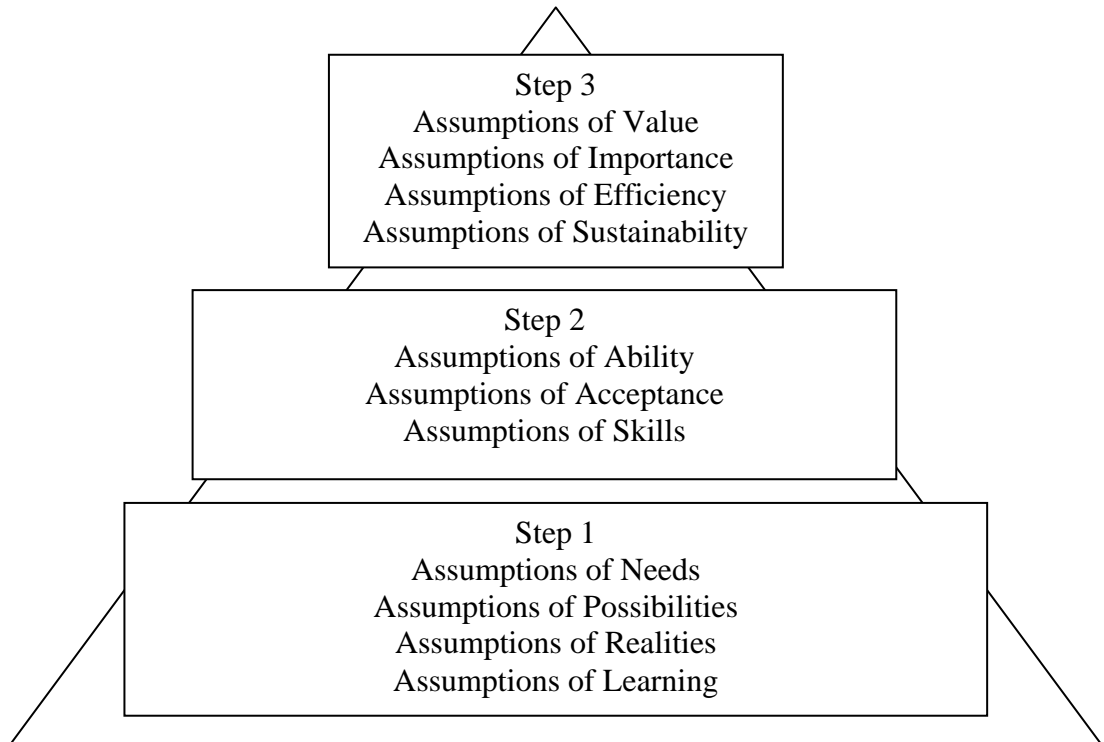


Figure 4. Model of Assumptions in Hierarchy.

Further research is needed to determine if these clusters of assumptions form a hierarchy. Often the superintendent started with assumptions of need when attempting to construct a shared mental model with principals, board members, teachers, or staff members.

Summary

Assumptions associated with technology approaches give guidance to superintendents regarding technology use in public schools. Innovation with technology constantly attempts to create value to improve schools and student achievement. Superintendents as problem solvers and decision makers, integrate technology into

Montana public schools using mental models supported by clusters of assumptions. Without questioning assumptions of acceptance, abilities, and skills, the superintendent may approach technology integration without support of the system. Sustainable technology approaches in schools, like a sustainable vision of technology, need assumptions to be tested with questioning at all steps of integration. A sharply focused mental model, developed in a shared context serves all stakeholders because everyone knows the rationale for direction in professional development, budgeting, planning processes, instructional approaches, and political actions. Furthermore, shared mental models facilitate the alignment of resources that in turn strengthens effectiveness of technology approaches.

Many researchers (Armstrong, 2000; Battle, 2004; Calhoun, 2004; Hoffman, 2003; Poole, 2003) have found that school leadership is a key factor to successful integration of technology. Yet, few models exist that explain how the underlying assumptions of a technology leadership approach work to integrate a district's vision of technology. This case study's model addresses the issue by describing the approaches and deconstructing the reasoning underlying these approaches. By understanding assumptions clusters, leadership can work with to improve clusters of constraint, anticipant support, and predict risks. Understanding assumption clusters are important to leadership success because without the knowledge, decisions to spend funds to implement of approaches may destabilize the superintendent's position.

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APPENDICES

APPENDIX A

PILOT CASE STUDY

Pilot Participant

The pilot case is about a Montana K-12 superintendent in a county-wide school district. The superintendent grew up on the Montana “Hi-Line”, the northern portion of Montana serviced by railroads and thus referred to commonly as the “Hi-Line”, in a small rural town of 250. The area has vast tracts of farm and ranch land. His family farmed several sections of this Northern Montana land located four miles from the Canadian border. He attended a K-12 school with a student population of 40, a graduating class of 15. College opportunity availed itself through a basketball scholarship at Western Montana College in Dillon. It is there he earned a teaching degree and served as student body president.

The superintendent first taught in his current district as a social studies teacher from 1981-1989. During this time the superintendent attended graduate classes in school administration at Montana State University in Bozeman. He received his Masters Degree in school leadership and was hired as a principal/activities director in Broadus, Montana. After serving in this capacity for four years, he became superintendent of the district for the next two years. It was in Broadus that he was involved as grant writer, editor in a technology learning project called SEMTEC (Southeast Montana Technology Education Consortium). The technology project tied 10 schools in southeastern Montana schools together with its own online video instruction. Schools could share classes and instructors. SEMTEC tied schools in the consortium into a college in Billings, Montana. His interest in technology evolved, like other educators, over a period of time in the school context. He has been in his current superintendent position for 13 years.

Pilot District

The pilot case district was a southwest Montana school with 721 students K-12. There were five trustees on the school board, three males and two females. The district built a new high school in 2001 and equipped the building with new computers including two lab settings; an additional retrofitted lab is housed in the elementary. Facility infrastructure incorporated T-1 internet use. The district has three T-1 internet lines presently, which serve a high school building, a junior high, and an elementary. The district is unique in that they have combined the school library with the community library on campus.

The district consolidated several local community schools including some one-room school houses over the past decades. The consolidation of these small school houses was completed in 1993. After consolidation, students were bused to a centrally located campus that included an elementary, junior high, and high school.

In 2008 the district enrolled 220 students in the high school, supported by one principal and eighteen instructional staff. The teacher pupil ratio was 14 to 1. Per pupil expenditure was \$5,305 per student. The junior high school grades 7 and 8 had 128 students, one principal and an instructional staff of nine. The teacher pupil ratio was 18 to 1. Per pupil expenditure was \$5,305 per student.

The PK-6 elementary school had 373 students, one principal, 26 teachers and 8 para-professionals. The teacher pupil ratio was 14 to 1. Per student expenditure was \$5,305 per student. In terms of computers in the elementary, there was a computer lab,

which was used primarily by the upper elementary grades, but to some extent K-2 as well. The elementary school had 5 Smart Boards and 6 digital Elmo Document Cameras. Every classroom was equipped with computers, at a rate of one per three students.

The community was located 32 miles from the state capital, which availed itself to resident work commuting. The town was the county seat with a court house, jail, sheriff's department, and several county offices within the three story brick building. A state east-west highway passed through part of town flanked by repair shops, car sales, boat sales and repair, and entrepreneurial niche businesses. One of the larger businesses along this east-west hwy coming into town was a ranch supply, fuel station. A few blocks down were larger, newer buildings housing Forest Service, Department of Natural Resources, and a Post Office. Railroad tracks parallel a state highway into town on the west with a grain loading facility conveniently situated between the highway and the tracks.

At a flashing yellow light, main street intersected itself from the east with businesses including real estate offices, banks, a hardware store, café, dentist office, and other main street businesses. A block off Main Street was a hospital, which includes a nursing home. A block away was the school campus with a football field and spacious playground area. Houses were concentrated in town, but there was development along the river at the edge of town and the lake a few miles away. These rural developments were mostly modest residential. Large ranches lay on the outskirts of town stretched east and west to the mountains, where Forest Service land was covered with pines.

The estimated population from the 2000 census report was 1,974 with an even distribution of males and females. The medium age of the county was 42 years with a median household income of 29,700. The estimated value of a home in 2005 was \$82,500.

A technology levy was passed in 2004 for \$50,000. This was a yearly levy for the depreciation of technology in the district. The levy was well supported by a margin 2 to 1. The school superintendent reported increased visits of the web pages by the parents, students, and community members.

The high school graduated 56 in 2006, 23 males and 33 females with an 86.7 graduation rate. The teaching staff included 17.16 full time equivalents (FTE) with a 12.8 to 1 student teacher ratio. The achievement results, 2007, on the Montana Criterion Referenced Tests (CRT) for 47 students in the 10th grade were 95.7% at or above proficiency for reading and 57.4% at or above proficiency for math.

The junior high school had a student teacher ratio of 15.2 to 1 with 8.437 teachers (FTE). The total enrollment was 128. Achievement results for the 7th grade were 87.1 % at or above proficiency in reading and 72.6% in math. Males achieved slightly lower than female counter-parts.

The elementary school posted results for grade 3, 4, 5, and 6. Grade 3 posted 82.7% at or above proficiency in reading and 71.2% in math. Grade 4 posted 82.6% at or above proficiency in reading and 56.5% in math. Grade 5 posted 80.4% at or above proficiency in reading and 54.9% in math. Grade 6 posted 90% at or above proficiency in reading and 62.5% in math.

The school was using the MISTA school improvement model. One of the district goals was to give teachers the opportunity to use and integrate technology into their curriculum area by 2005-2006.

Pilot Case Findings

A pilot case study was implemented to test and practice case study research methodology. This pilot study was used as a means to improve the research with practice collecting and reporting data. The pilot case study was guided by the same research questions: What assumptions does a superintendent with a high reputation for technology hold in managerial, instructional and politics roles? The purpose was also identical to the case study: to understand the technology approaches of a superintendent with a high reputation for technology in order to learn new applicable approaches and the underlying beliefs for the approach's implementation.

By interviewing the superintendent, high school principal, elementary principal, members of the technology committee in a focus group, technology coordinator, and the chairman of the school board, information emerged about technology approaches in the school district. Field notes included informal interviews and observations. Print and non-print artifacts provided additional data.

The superintendent reported experiencing a substantial amount of technological change during his 13 years as superintendent. The new high school building was equipped for a shared value of integrated technology. The superintendent explained,

One of the labs sits between two English classes and its open for students and classes to go in and use. And then I have a lab here right across from my office

that's open as well. And then we have a lab in the elementary that we have had some success with, limited with older technology that has caused some problems, access and getting it to work properly for all the staff (Superintendent, 2008, p. 2).

Observations recorded in the field notes provided descriptions:

The superintendent's office is an open door in a divided office with the school clerk. From the hallway, visitors step into a large clerk's office with the superintendent's door on the left divided by waist to ceiling windows. Both spaces have computers, printers, a shared copy machine and shredder. Both are connected by network and to the internet. As I observed the clerk's work after the March board meeting, the electric stapler fastened warrants with invoices. Occasionally, her attention focused on a printable calculator. With a window at her back and a clean professional office, she rarely stopped. Her one person online operation accounted for a \$3,825,000 budget (Anderson, 2008, p.14).

The superintendent was observed working in his office, and descriptions recorded in the field notes:

The superintendent was an approachable, sincere, multi-tasker, who gave time to people. In a 20 minute period observation, the superintendent sat at his desk with an open computer screen composing a letter, answered two phone calls (one regarding help with a disabled program and one concerning hiring), listened to his answering machine and returned two phone calls regarding an open position. When the counselor stood in his doorway, he stopped what he was doing to answer the counselor's question regarding an invoice and warrant for a career day speaker. He and the counselor stepped out of his space and talked with the clerk, who quickly produced a payment warrant printed from the accounting software.

Returning to his office space, he continued writing his letter on the computer, occasionally referring to stapled sheets. He later shared his approach. He used Microsoft publisher to organize his notes. The printed copies were stapled together with highlights and cross outs. He showed the organizer and commented it was a good way to organize tasks as a superintendent. The sheet compiled a list of 45 items to be accomplished. He flipped to the previous month and explained task carry-over. He pointed to the calendar in the upper-left corner. The sheet was divided into several sub-categories: board notes, principals, janitor notes, technology items, things to do, district clerk, service clubs, and miscellaneous. A line was drawn through a few items on the task list, but a hefty load remained.

The elementary principal knocked and a congenial discussion ensued. The screen saver eclipsed and the answering machine went quietly back to work. The clerk had been busily shifting attention from printed copies to her computer

screen. There was absolutely no tension in the neat, new, well lighted rooms. The superintendent's office posters of leadership, quality, integrity, teamwork, wellness, and determination flanked the plaque with the district vision and mission (Anderson, 2008, p.14-15).

After the observation, the superintendent smiled and said, "We also want our students to have an introduction to online learning. I see a more flexible student learning schedule for the future. I think it would be helpful to talk to our technology person." He called the technology coordinator, who answered on his Blackberry.

Managerial Role Efficiencies Attributed to Technology

The superintendent's preferred technological management approaches in the district office and in the schools for student management. When asked the question, "What would be the effects if technology wasn't available to help manage the district?"

The superintendent exclaimed,

It would be phenomenal! Our grading program is technology based. So, the student information system would be gone. The time it would take to do that by hand, the loss in time would be phenomenal. We use technology so much. I think if we had to go back, there would be an absolute revolt. I don't know if we could do without it. If you look at the curriculum, the business classes, their whole curriculum would be back to hand entry, rather than computerized journal entry. Instruction would change for some teachers, who use smart boards and digital projectors in their lessons. It would definitely be a loss. I know for a fact that we'd have to hire an additional person - a payroll clerk or a claim's clerk because the job would be would be impossible (Superintendent, 2008, p. 9).

The high school principal explained that "...very little was done with cash.

Warrants are printed electronically for payments, but in the end it's easy to account electronically."

The board chairman relied on spreadsheets provided by the superintendent to understand, “where the money has gone”.

The district was replete with efficiencies attributed to technology in management according to the high school principal, “All the classes that are offered (scheduling) and like, I said, the grades are done with technology. Our board policies are on the web pages. I think there's one hard copy and that's in superintendent's office and all the rest are on the homepage.”

The board chairman reflected, “The superintendent can get information to us quicker with email, rather than having to call everybody.”

Without technology to manage the district, there would be a great loss of efficiency for his district operations according to the superintendent,

You know one of the things I will say about it, one thing that I think would be easily overlooked is the safety factor. We have cameras throughout the building; there would be safety issues there. In case of an emergency contacting people, cell phones, we post school information on the webpage, and we have a school radio station. I think I could spend a week and not get my arms around the question of what would be lost if we didn't have technology! I think I would always think of something else that was technology-based in the accounting system or student system (Superintendent, 2008, p. 9).

The superintendent's use of technology makes it evident that he holds and assumption of technology's efficiency. The superintendent managed day-to-day operations with tools of technology. Answering a question about technology and managerial changes to his role the superintendent said, “Managerial wise, I would say I use Excel a ton, publisher of bunch. You know as far as e-mail, that's instant communication.”

The elementary principal had witnessed the superintendent using technology,

He is a PowerPoint guy. At the start of year, he starts off with a PowerPoint presentation, he uses that with the board, he uses it with civic groups, he is very big into e-mailing information back and forth, he is very hooked into that whole thing sending you an e-mail, if you need to do this or do that, and you know if there's important information he would like for you to know. It gives you a good record of things and so is used heavily by him (Elementary Principal, 2008, p. 5).

The superintendent gave his reasoning for email, "I use it a lot with my principals in case there was something that that I wanted them to remember, such as planning a fire drill or something like that, I know that it's immediately to them."

During negotiations the superintendent used technology with spreadsheets. In the superintendent's own words,

Without Excel I would spend hours figuring out this year's budget or projecting next year's budget, a lot of things like that. In the negotiation process, if the teachers say I want a \$200 raise, I can tell you exactly to the dollar what that would be with one entry into a cell. I have a setup where I have all the staff salaries, raises, integrated together. I can put inputs in and tell you exactly what it would be (Superintendent, 2008, p. 10).

The chairman pointed out the efficiency of technology in the process,

He puts everything together in the computer and then if we want to give teachers a certain amount and we have a certain amount before we have to run a mill levy or something, he can budget right into his computer and immediately it's right there. It's pretty darn close. It has to be, I guess. And the insurance, he just punches in the numbers, and it comes out for each person and then there be a total right there instantly. So it's pretty efficient. Without that it would probably take hours to do that by hand (Chairman, 2008, p. 6).

The superintendent used the technology plan in his managerial role. The technology plan posted on the district's web page had an inventory of equipment in it. The technology committee elaborated during the focus group, "Yeah, the technology plan does have a complete inventory of everything and when it was purchased. He knows

what was spent last year and he knows what needs to be spent this year.” The high school principal said,

I guess the technology plan would be the backbone of his decision-making, that we have a plan in place and he's going to shoot for the goals that we have in that plan. I know we revamp that every few years, if you look at five-year plan and you look back at them every year or two to make sure that we're online to accomplish those goals. The superintendent is very goal oriented (High School Principal, 2008, p. 3)

The technology committee focus group provided insight on management through the technology plan,

Our technology plan if you haven't already seen, TAGLIT (Taking a Good Look at Instructional Technology) gives an overall picture. It's a picture in time of where the staff feels they are, and the students have a chance to comment, saying things like, this computer lab is really slow or outdated, why do we even have the lab because it doesn't work half the time. It gives you a target of measurement. If there is a problem we need to address, we can. It helps identify these things.

Part of our technology plan that we have submitted to OPI (Office of Public Instruction) is broken down by the standards and outlined by grades 1 through 4 and 5 through 8. In high school, we also determine what needs to happen at each grade level and you will see that it's in pretty clear language (Focus group, 2008, p. 5).

A technology committee member linked financial management with the technology plan, “I think the technology plan influences his [the superintendent's] decisions on the budget, for examples, look at the rotation of our labs, the teacher's computers, and he'll say we need to replace 15 computers for teachers.”

A snow storm blew into Montana the week before visiting the district. Students and parents were informed about road conditions by clicking on weather links on the district home page. The radio station channel is boldly displayed on the district's homepage. The school radio station supplied information on buses and school closures.

The high school principal said, “We use the schools radio station, webpage, and email efficiencies as safety tools for students. “

The superintendent described the technologies used in the radio station,

This first semester was able to offer a radio class where students created the sound bites that go on the radio. Every thing is not advertising, but sponsorships, and updates for the public as far as lunch menus school activities weather alerts, those types of things. It’s a pretty simple radio station that’s a live Internet feed and it services most of Broadwater County gets 100 W, public radio station. The students are amazing with a program called Gold Wave. They can build the file and add background music, edit out words and phrases, while inserting other sounds (Superintendent, 2008, p. 4).

The superintendent concentrated district’s professional development on vendor provided web page authoring for teachers. The superintendent was a bit disappointed by the State’s TAGLIT evaluation report following a two year effort. (TAGLIT is an online self-assessment survey given to teachers, administrators, and students in Montana school districts to access perceptions of technology knowledge and skills. TAGLIT is an official measurement used to gauge progress on technology goals in the technology plan.) The superintendent explained,

TAGLIT gives an assessment of where teachers are as a group. We will provide some specific training, targeted to needs from that assessment. Our staff spent one whole year. We trained our staff how to write their own webpage, how to insert stuff, how to edit, what should go on there. And they could, but the way the question was worded they voted themselves down because they interpreted the question differently. They thought, sure I can do it for the school, but I couldn't just do it without the software and that was one area where we really concentrated technology training for staff. I would say webpage development is a big one [professional development approach] for the last two years (Superintendent, 2008, p. 5).

The communication efficiencies extended to all stakeholders in the district including the parents and students. The high school principal described levels of

communication and the efficiencies of stakeholders, “The thing about our web site is that you can sign in as a parent, as a teacher, as an administrator, and you have different levels of access and security.”

The analysis of the district web site provided data for descriptions of information that the superintendent considered important. The district implemented Schoolwires, a program with layered levels of access. From the field notes,

The public has access to the school homepage with a menu including: administration, adult education, after school program, agriculture, athletics, bug/weed project, cafeteria, clubs/organizations, curriculum, library, parent tips, public notices, publications, school newsletter, teachers/staff, wellness plan and calendar. The home page included telephone numbers for the high school office, elementary office, and superintendent’s office. The school radio station’s dial number was listed.

The public had access to the school mission statement on the web site. Linked to the public homepage were the spring sports schedules, One Day Tree Project, Missoula Children’s Theater information, travel information and web cams, parent and student surveys for the year, the high school and junior high grade books, middle school information, elementary school information, the school newspaper, and a technology questionnaire (Anderson, 2008, p. 22).

The teachers had access to STI’s (Software Technology, Inc.) office, classroom, district, and state data. With a password, a second layer of access is permitted classified staff. From the field notes:

Given a password from the superintendent, access was gained. A headline appeared “Cyber School” Stipend Answers from the superintendent. The article was an explanation of online in-service training for staff for the school year. A message from the superintendent came up, “There is a constitutional, legislative, and moral mandate for all districts in Montana to provide appropriate Indian Education to students. Although “Cyber School” was originally chosen for the Native American component, the superintendent found that it could easily address individual technology needs of staff members as well.

The superintendent explained on the web page that Title II, Part D federal money was contingent upon our scores on the TAGLIT survey. The superintendent went on to answer several questions: (1) Is all of this mandatory to all staff?, (2) What are the consequences of not completing the training and

testing?, (3) Is there a stipend for completing the training and tests?, (4) How much is the stipend for the Indian Educations and Microsoft?, (5) Who do we need to notify about completion?, (6) What is the time frame for us to complete all of the materials, and (7) What are all the requirements for this training?

This second level of access contained requisitions and office forms available for certified and classified staff. A set of menus linked a myriad of managerial forms: (1) Application for use of school facility, (2) Authorization for release of records/information, (3) Equipment check out, (4) Fundraiser approval form, (5) General office supply order form, (6) Leave request form, (7) Media and web site release form, (8) Payroll and reimbursement forms, (9) requisition forms, (10) school bus inspection form, (11) travel form, (12) volunteer or employee vehicle usage form, (13) Weight room liability release form

The third level of access was for students and teachers, who had an identification number and a pin for STI (Software Technology, Inc) data base of student and staff demographics, attendance, transcripts, scheduling, grade reporting and discipline tracking. Firewalls allowed different demographics access to particular aspects of data. The full blown web based STI software also included assessment, achievement, special education, and financial components (Anderson, 2008, p. 22).

The superintendent was proud to say that the district connected parents with the school in the third level of access,

Parents can find their student's grades right now online. They can see what the assignments are and what assignments are in or are out on an almost instantaneous basis. From when the teachers post them, the parents have access to teacher web pages in every class in high school. Student might say how did I do on my history test? If the teacher has posted grades, student and parent can see the results immediately (Superintendent, 2008, p. 9).

The superintendent's approaches with technology created efficiencies for parents.

In the focus group they commented,

One member of the group added, "He [the superintendent] also has been offering adult education and a class in technology, which I think helps the community see how useful it is in the classroom. The technology focus group also emphasized the importance of the grade books, attendance, and lunch counts online (Focus group, 2008, p. 7).

From a parent perspective, the Board chairman explained, he could access his sons' grades and assignments, whenever he wants. While sitting in his business office

during an interview, it was noticed that two numbers were written on a note card by his computer screen. Guessing it might be his access login, it was asked, “How the electronic grading system worked?” He commented that he wasn’t able to make the teacher conferences, but he did talk to his student about a particular grade and assignments.

In the superintendent’s words,

There is a convenience to web page communication. People can go immediately to a web page and find out what the activities are in the district, or find out what the assignments are from a teacher. A student might have forgotten their spelling words when at home. And a parent can go to the teacher’s website and take them off the web page when the kids are at home, they don’t have to run back to school or back to town. I think that web pages helped with a managerial part, cooperation with parents. Once parents are trained that electronic grades are available, and they can use it, then we can increase their involvement (Superintendent, 2008, p. 10).

A teacher made the point, “If I have somebody absent from class, it’s so nice just to go to a webpage and print off the notes they missed from that day.”

Observations recorded in field notes:

Observing a geometry class, the teacher collected assignments from students. One student was absent the day before. Thinking maybe that the student borrowed a friend’s notes or spent time on the phone with a classmate or the instructor, it was revealed that the student went to the teacher’s webpage and went through the lesson posted in PowerPoints. The lesson plan, teacher lesson notes, and assignment were posted for the students. He handed his assignment in on-time like the others.

Students, who were doing homework, could use the web based teacher notes at home. At one point a classroom the geometry teacher offered to email his PowerPoint notes to students, so they could review at home. There is immediate feedback for students from tests and grades, as the CPS grades tests and quizzes. Another teacher commented that it takes about 10 minutes to put grades into STI system (Anderson, 2008, p. 5).

In the focus group a business teacher said,

The kids can actually login and look up their grades, their assignments,

what they got on their assignments, the teacher's comments. I think that is really gotten kids involved in their grades, because before the bell rings I'll have kids sitting down (at the computer) checking their grades in their other classes. I know kids are using it because they'll be discussing missing assignments and be searching teacher web pages (Focus group, 2008, p. 13).

The superintendent's admitted his managerial role had been changed by technology. He explained recent changes from the Montana Office of Public Instruction to track students in Montana, "Right now the State is going through a change, a system called AIM, (Achievement in Montana). After you get through the pains taking parts of the training and how the system works, it is highly efficient." The superintendent described staff effort needed to learn the new technology system to meet the new changes, "Every student in the state will have a number, so if they transfer to a different district, that number follows them in their files." The secretaries, counselors, technology people spent an inordinate amount of time getting all the information in, the way they wanted it in. And, our program isn't the same as the State's, so we had to convert different pieces and parts. The reality is, it has been a lot of work, but the next step is the greater efficiency. It will be better for everybody. However, he admitted imputing data from district level technological systems that were not compatible with State software was problematic. The learning curve was a concern for the superintendent because he had to commit human resources that had an associated district expense.

In summary the superintendent's believed that technology was invaluable to management of his district operations because it increased efficiency. At the district level, using technology to account for budgets was essential to the superintendent. With the amount of student data the superintendent had to collect and report, technology was

critical to efficient operations. He reported changes his managerial roles with technology and cited OPI changes in student tracking statewide as new efficiencies.

The Importance of Technology to Instruction and Learning

The superintendent believed that technology was important to instruction and learning. The superintendent's assumptions regarding technology use in learning and instruction stemmed from Prensky's (2001) research that theorized, "Our students have changed radically. Today's students are no longer the people our educational system was designed to teach." From the interview with the superintendent, in his own words,

To be honest with you, there are some phrases digital natives and digital immigrants we discuss. The kids are digital natives and the adults are the digital immigrants. The fact that, students and what they can do on a cell phone is absolutely amazing with the texting; not many adults know how to do that or use it (superintendent, 2008, p.4).

The elementary principal extended me a copy of an article, "Digital Natives, Digital Immigrants, Part I." Changes in today's students have occurred, according to Prensky (2001), because of the ubiquitous digital environment in which they live. Computer games, email, the Internet, cell phones, and instant messaging have become a fast paced, integral part of their lives. This has caused thinking patterns to change. Prensky (2001) explained that differences cause a disconnection between traditional schooling and technological learning that digital natives have developed through environmental exposure. He felt that digital immigrant teachers didn't take advantage of digital native skills and abilities in schools which caused problems for student learning (see Table 8). The superintendent's belief that Digital Natives and Digital Immigrants

existed helped explain his support for technology in instruction. The assumption of matching learning styles with learning strengths was supported by learning style research in Multiple Intelligences (Gardner & Hatch, 1989).

Table 8. Prensky’s Differences between Learners.

Digital Native Learners	Digital Immigrant Teachers
Prefer receiving information quickly.	Prefer slow and controlled release of information.
Prefer parallel processing and multitasking.	Prefer singular processing and single or limited tasking.
Prefer processing pictures, sounds, and video before text.	Prefer to provide text before pictures, sound, and video.
Prefer random access to hyperlinked multimedia information.	Prefer to provide information linearly, logically, and sequentially.
Prefer to interact/network simultaneously with many others.	Prefer to work independently rather than network and interact.
Prefer games to “serious” work.	Prefer to teach from a text.
Prefer instant gratification and instant rewards.	Prefer deferred gratification and deferred rewards.
Prefer learning that is relevant, instantly useful and fun.	Prefer to teach to the curriculum guide and standardized tests.
Prefer use of new digital skills.	Prefer to downplay technical digital skills.

Prensky (2001) supplies evidence citing Dr. D. Berry of Baylor College of Medicine, “Different kinds of experiences lead to different brain structure.” Prensky says that research provided new evidence that brain stimulation of various kinds actually changes brain structures and affects the way people think, and that these transformations go on throughout life. Brain cell neuroplasticity is a lens to understand learning with

technology (Wolfe, 2001). When member checked, the superintendent confirmed that he believed that children were influenced by technology in their environments and these digital influences were linked to student learning preferences. Prensky research supported the superintendent's belief in the importance of technological approaches in instruction and learning to motivate students.

The superintendent's believed that technology in instruction could be used to help students learn content. Field notes of math classroom observation:

A gentleman, a retired extension agent, stood in the hallway waiting to substitute a geometry math class of 20 students.

The week before the regular geometry teacher was teaching surface areas of triangles in tetrahedrons. Each student had their own calculator on before the bell rung. The teacher turned on his laptop, which projected a Windows screen on a Smartboard. His overhead projector projected his TI calculator display on an adjacent screen. With a double tap on the Smartboard screen an outline two feet tall of a tetrahedron appeared. He wrote the height number on the Smartboard screen. He outlined the triangle within the tetrahedron he wanted the students to identify. The problem was from their textbook. The students provided the base number. The teacher drew the triangle next to the tetrahedron on the Smartboard screen. The students' heads nodded. The teacher turned to the overhead and punched in the numbers for the height and base. The students emulated his demonstration on their TI (Texas Instrument) calculators. With the three surfaces lengths found, he marked them on the triangle next the tetrahedron on the Smartboard. His explanation of the surface area translated into calculations to the students, who raised their hands with answers. "Is there anyone who doesn't understand?" Timidly, a few faces gave up the confusion. The teacher turned to the Smartboard and pointed at a number in relation to the triangle and then energetically punched the numbers into his calculator connected to an overhead projector. "Do you have that part?" He snapped his attention back to the Smartboard pointed to a second set of numbers and energetically punched the numbers into his display. "Do you see that?" One student still didn't get the correct answer. "My calculator didn't give me that answer!" The teacher turned to her and step-by-step analyzed her numbers. "Did you square that?" The total observation of the process was four minutes.

Now preparing to substitute teach this class, the retired extension agent had the technology coordinator turn on the laptop and get it displayed on the Smartboard. He said he had substituted in the school before and was pretty use to

the Smartboard. In fact, he had used similar technology as an extension agent. The technology coordinator worked him through operation details.

An elementary counselor stood in the hallway waiting to speak to someone in the office. Asked about the difficulty substitutes may have, she said that the junior high math teacher video recorded his lesson before he was absent and all the sub had to do was play the video.

In retrospect, at the end of the regular math teacher's lesson on tetrahedrons he asked the class if they wanted the notes. The geometry teacher said, "I will email them to ya." One student who was absent the previous day turned in his assignment on time by going to the teacher's web page, there the teacher had his lesson notes in PowerPoint slides. At the end of his lesson he reminded the students that they could use his webpage to review at home, if they needed to (Anderson, 2008, p. 3-5).

The geometry teacher pointed out the advantages of technology in instruction, "I teach the same classes, three geometries during the day. And my examples are the same every hour, I don't have to rewrite them on the chalkboard, it's all prepared." He went on to say, "Then I'll take those Power Points to my web page for this class and the students can access everything we did in class at home, if they need to."

The superintendent went on to explain the importance of using technology in instruction to connect the real lives of students and the world-of-work, when he said, "I think any time you can apply or the students can see instruction that applies to real-life, they're more likely to use it. I think I'm a believer to that students need to have an active role in learning."

The superintendent emphasized the importance of technology in real life, hands-on learning for students. The high school had several classes with real life, career orientations and applications. The superintendent's support for these approaches stems from assumptions of relevance to real-life applications. The superintendent talked about several approaches that connected his belief to instruction.

The one thing that we do that schools may not, is we have a class in GPS, which is another piece of technology. We also use that for a business enterprise. In the summer students go out and map knapweed and leafy spurge, noxious weeds. Then they take their maps and the county uses them for grant money to combat the weeds. We then take it a step further and have a biological control agent. We grow insects, weevils that eat the weeds. See the real-life application, students understand that experience as a real-life application and say, makes sense to me and why I'm learning this because this is how it is applied in a real-life. The nice part about our summer a business is that they get paid for what they're doing and that's a big incentive for students, as well (Superintendent, 2008, p. 2).

The business teacher said that she was just in the beginning stages of the GPS training with the students. She said that students first learned how to use the technology and then uses were fit into the curriculum. A previous year, the GPS students mapped the local golf course. The summer program plotted noxious weed locations for insect releases to combat noxious weeds. The superintendent beamed, "It's a great learning experience for students in a hands-on application."

Observations written in the field notes of industrial arts revealed other real-life learning connections that made by integrating technology,

The shop teacher referred to himself as the tech ed. instructor. The connotation differentiated the approach to his program. He just returned from the morning half day of career workshops scheduled by the counselors. He said that he had just spoken to a mechanic from the local dealership about technology use in the automotive field after a presentation to the students. The tech ed. instructor mentioned scanners for car diagnostics. The said he had some that students were able to use, older models. He said that it wasn't imperative to have equipment for current year models like the dealerships, but students did use scanners as part of the automotive curriculum. He went on the show the technology used to make joints for cabinets. He said, "We use Excel to build material lists."

As we went up stairs, we passed a student turning threads on a lathe and two others welding. In the lofted room upstairs, he pointed to a dusty computer and the CNC (computer numerical control) unit. He explained that he taught computer numerical controls in a computer aided manufacturing (CAM) unit. He was proud to say, "This is an introduction to mechanical engineering. The students design a car in this class." He talked about a graduate who owns an amphibious vehicle company in town.

We went down the steps into the hallway, where the tech ed. instructor pointed to a series of home plans on the wall. The students use Micro-station V8, 2004 with the HP plotter. The plans were specific. Each stud in the wall and roof structure could be counted. The window and door framing could be examined for details and consulted as it was built. Lengths, sizes and amounts were available to students to estimate costs. The tech ed. teacher walked into the classroom and turned on the computer and an image of the display was projected onto a screen behind his desk. He looked at his computer screen. He pulled up some student examples of home designs on his computer and explained the layering of the building. He said they draw the foundation, roof, and everything needed to build the structure.

The students were avid digital photographers he mentioned and these presentations often include digital pictures with graphics. He mentioned that by saving the Power Points on the server, the students could call up their projects during the day and work on them anywhere in the school (Anderson, 2008, p. 21-22).

The tech ed. teacher explained another technology assignment, "I also ask the students to teach something new in technology using technology. The students make 15 slides in PowerPoint with some innovative content."

The high school principal was serious when talking about the opportunities his students had to explore real life applications relating to technology. He mentioned the student radio station, business classes, and projects in industrial arts.

A math teacher commented on connecting the curriculum to the future, "There are just so many real world applications in the school already, so when they graduate or go to school this information's going to be available to these kids." The math teacher elaborated, "... I know our industrial arts teacher incorporates AutoCAD, and it's the latest version. So if the kids go someplace, whether it's to school or work, they are familiar with the latest software that's available."

The superintendent believed that technology integrated in instruction could improve learning. When asked if he used technology to motivate kids? The

superintendent flatly said, “Correct.” The elementary principal provided additional support,

This is the techie generation. They [students] love all things technical and generally know more than the staff about certain aspects of it, they are very, very good or very skilled, so what you sort of have to do is build on that. And I think [the superintendent], understands that, that’s what this generation is about, is technology. He tries to always build...upon that (Elementary Principal, 2008, p. 3).

From the observation field notes of an elementary class:

The students in the second grade class were learning abbreviations. The teacher went to her laptop and started a PowerPoint with a stereo sound experience that captured the students’ attention. Suddenly a map of the U.S.A. appeared on the Smart board. The screen froze and she asked the students what U.S.A. means and they say in choral “United States of America”.

The PowerPoint continued with abbreviation rules including capitalization of letters and punctuation. The teacher tapped the smart board screen to bring up a slide. A name appeared, “Mister Sandoz.” The students were asked who can abbreviate “Mister Sandoz.” Several raised their hands and the teacher chose a student to come up to the Smart board screen. The little girl shuffled through the colored pens and picked a bright blue. She wrote “Mr. Sandoz.” The second problem stated, “Doctor Elizabeth Blackwell. Again the students raised their hands and one was chosen to come up to the Smart board and write the answer with their choice of color of pen. The interactive guided practice continued until all the students had a chance to write on the Smart board. Students smiled throughout the lesson and hoped to get a chance to write their responses on the Smart Board.

The abbreviations became tougher as the class progressed, “Pennsylvania Avenue.” As the student wrote the answer, the teacher asked the class what was special about “Pennsylvania Avenue?” The teacher asked students to use their planner’s map and they found the White House address. Another abbreviation was “Rodeo Drive” and the teacher worked on pronunciation of “Rodeo.” She said, “We don’t have Boulevards here do we?” Ten minutes into the class the teacher put up a slide with a postage address on it, “Sylvia Levy, Post Office Box 3882, Atlanta, Georgia 30304. Students together spelled out the word needed to be abbreviated. The teacher said, “How would you abbreviate the second line?” The students responded laughing and about how easy it is. The teacher said, “How do you abbreviate the third line?” The answers ensued. Then one student went to his planner and said, “Capital ‘G’, Capital ‘A’.

The teacher said, “Where do I put this (referring to the name and address) on an envelop?” A slide appeared with the name addressed to Sylvia Levy, and a

return address of the teacher in the upper left corner. The class ended with a crossword puzzle on the smart board with the students' vocabulary. One by one students went to the laptop and spelled the vocabulary words into the cross word puzzle as it appeared on the Smart board screen. The spelling and vocabulary words had been incorporated into the lesson with technology. Content standards had been covered, technology had been learned, and student interest stayed high (Anderson, 2008, p.11-13).

The elementary principal talked about motivating students in the classroom with streaming video being used throughout the district. "I don't care when you teach about slavery or the Kennedy assassination or global warming, there are clips on there." The clips referred to actual footage of historical events. In the high school, a teacher talked about video streaming. "A lot of classrooms have projectors; we have subscriptions to streaming videos. I know science uses it a ton." The elementary principal added, "We also have Knowledge Box which is another level of a technology, where there are film clips on there for the teachers." When asked if he used technology to increase student achievement, the superintendent said,

Yeah, we use it [technology] in the process to improve student achievement. Well, if you look here (superintendent took out sheets of AYP progress) here's how we use technology." The results that we get back from the standardized tests are copied from OPI postings. We create the graph in a simple publisher program, put the numbers from I-analyze in it, yes it is quite a process. I am not going to take credit for this format because I have a great staff member who takes care of a lot of this (Superintendent, 2008, p. 8).

The superintendent was in the process of testing new assessment approaches with technology to improve student learning. A technology committee member commented in the focus group, "We have Classroom performance systems (CPS)!"

The second member added, “It’s testing and stuff using a remote through the computer. The computer grades it! Then you can use it for analysis of your class and student achievement from content.”

A focus group member continued, “It’s great feedback for your kids because if you take this huge multiple choice question test, when they’re done, boom, there is their results. They can see what they got right.”

The superintendent put data sheets together to show the district’s overall test performance by the different groups. He continued to explain, “The public sees the data. We post it on our webpage.”

The technology focus group addressed the superintendent’s commitment of time and resources to learn technology for improving student achievement, by saying

... in-service every year, we spend a couple hours refreshing our memories about I-analyze, what you can do and this is what you can do.” The assumption of value held by the superintendent is commensurate with time and resources. Teachers can help prepare students for state testing by learning to nuances of the States CRT’s (criterion referenced tests) (Focus group, 2008, p. 3).

The high school principal said, “Some teachers use OPI’s I-analyze. They get online and have the students look at some test questions.” The superintendent explained how technology generated data help improve students’ learning,

There’s a program called I-analyze, and you can go in and look at test results and see what specific questions kids have missed on the test. Then we set a goal where we can do a better job with prepositions or those types of things. Yet, what I like about this is that you can really get into some specifics. Teachers use it and in the curriculum (Superintendent, 2008, p. 7).

A math teacher explained how professional development in I-Analyze translated to the student preparation,

I'll pull example questions right up on my Smart Board and go through this is what they expect. So the kids know what is expected on the test. One thing that is important is that they don't always have to justify their answers in math class, but they have to show their work on the test. I started incorporating that more in my lower classes, show your work, show your work, and show your work (Focus group, 2008, p. 6).

Another teacher in the focus group pointed out, "We can go to I-Analyze as part of OPI's standardized test site. With our technology, we can see test scores, individual test scores. We use I-analyze to make sure that the kids are prepared for the test."

The chairman of the board supported instructional approaches after understanding online learning that his son was taking. He talked about how it worked,

Right now he's taking an online class from the University of Great Falls, over the Internet. It's a psychology class. You get college credit for that. He does that school. He goes in and works on it during the school day. We had to buy the textbook. But it is less for them to take it all over the Internet. He goes into one of the labs for one of his class hours. He may be doing one class on his computer and somebody else might be doing another class right next to him (Chairman, 2008, p. 2).

In summary, the superintendent held a tacit assumption that instruction that incorporated technology could help students learn. The belief that the environment outside school provided technology learning experiences for students led to the belief that these technological skills could be used and enhanced in school for a variety of reasons: (1) to prepare students for the future world of work, (2) to motivate students in school, (3) to allow students a chance to learn how to learn with technology, and (4) to give learning real-life relevance.

The superintendent also believed that student achievement could be increased with technology. He used OPI data bases to guide instruction. Teachers in turn used data with students to help them achieve.

Professional Development in Technology

The superintendent held the belief that technology training was needed to enable teachers to use technology in instruction. He also believed that technology could be used to deliver professional development. The superintendent used the technology committee to develop approaches. The technology committee focus group commented,

He meets with us and we talk about what we should be working on in the district to get everybody up to par. He's the one that sets up all our in-service training during the year. And we decided on doing e-mail training this year, or do we need webpage training, or do we need grade book training or anything like that? (Focus group, 2008, p. 3).

Members of the technology committee had been resources to address the technology learning curve for other teachers. During the focus group interview, it was pointed out, "For a few years now there's been a few of us teaching the in-service and now there's about five or six." The superintendent said, "We have people in the district that serve as mentors. One teacher may not be comfortable asking somebody, but there is enough trained staff that resources are available so I can ask somebody else. There is a lot of that cross training that is done without being mandated."

The superintendent's belief that instruction with technology benefited students led to hiring technology savvy staff which added mentoring capacity. A technology committee member pointed out, "For example, we have a new teacher she's only been here two years, and she has a newer Smart Board and she's using it just about every day in her classroom. Now these new teachers coming in, they have to take classes in technology." Another member added, "So, a lot of the new teachers that we're hiring, they will say I want smart Board ... in the room." A teacher commented about when they

first received Smart Boards, “I know when we first got the smart boards and it's been a few years now since we've got them, they came in trained a few of us.”

Observations of an elementary teachers’ meeting in the field notes revealed professional development in technology by putting teachers in the role of teaching colleagues with technology:

Before school at 7:30, the elementary teachers poured in for a teachers’ meeting. The principal arranged to have a teacher present R.B.I. (research based intervention). The teacher had a folder of white sheets with large printed letters. She used an Elmo Document Camera to project the introduction RBI onto the screen. The group perked up when the next sheet is projected “Will a school reform model work with you?” The young teacher was obviously nervous to be in front of the group presenting for professional development with technology, but the others responded with questions and good discussion followed about goals, definitions, and strategies. Ten minutes later, it was summed up by the teachers and elementary principal. The elementary counselor presented some new information on testing, reminding the teachers that they had to give the tests, not aides. She said she would email some information to all of them about times and dates. A group of teachers then reported on the progress of weight loss groups. They also said they would email the results of the monthly effort of the different teams. They laughed and told the presenter she did a good job. She smiled in relief. (Anderson, 2008, p. 7).

The superintendent used in-service at the beginning of the school year according to the elementary principal, who outlined the approach, “Basically, he has initiatives that he has each year which involve the entire staff K-12. This year...There is a technology tutorial thing that we’re working through for all his staff, so they can become more skilled learning with technology.”

The superintendent explained the State requirement of Indian education and the integrated technological approach for in-service,

One change we've made this year is a specific change for training our teachers. We’re in the first year of a new model and kind of looking at trends. I would say the old model we would say we’re scheduling one day and they will have the

speaker come in and teach about a specific program. What we have gone to is an online model in two areas: one is “Indian education for all” the program tracks you. Teachers can go in twenty-four seven whenever they want, and go through the lessons. It will document what you have taken and when. It covers all the tribes in Montana. It also has the technology part where there is a pretest. They can access where their skills are, then take the training, and post test. They would either pass or fail that lesson. So they can use that training as much as they want as much as they have incentive (Superintendent, 2008, p. 5).

The high school principal discussed the professional development effort regarding technology, when he said,

We offer staff development before the school year starts. The teachers can use those as PIR days in lieu of MEA days. So if they want to come in, it’s usually technology-based classes for staff development.

Well, each year we offer update on the website software. It also gives training in how to use a smart board. Or they can learn how to use different software. We kind of poll them and see what they want or what they need. And then we take one of our early releases. This year, we incorporated Indian Ed with the technology which took care of two state requirements for us (High School Principal, 2008, p. 3).

According to a technology committee member, “I think expectations for technology use is almost an understood expectation; if you have it in your room you should be using it. That’s been a stumbling block for a lot of the teachers.” Another member of the technology committee focus group explained a problem of integrating technology, “The big concern about that is, we hear, teachers just don’t have the time.”

The technology committee agreed that teachers should write technology goals and explain the steps they went through to accomplish the goals in evaluation. A teacher said, “We had to write one technology goal this year for an evaluation. And then we had to show the steps that we try to accomplish that technology goal.” The high school principal said,

Yes, technology is part of the teacher evaluation. You know, I go around class to class to see what they are doing. During my formal and informal observations, I am in and out. I read their lesson plans to see what they're doing. I want to know if there using some technology that they have. Given the most part, most teachers do utilize the technology (High School Principal, 2008, p. 2).

A teacher said, "He [the superintendent] comes into my room quite frequently, to just see what I'm doing with technology because he's the type of guy who, if he spends money, he wants you to use it and he wants to see what you're doing with it."

A technology committee member brought up managing technology goals, "We just updated our technology plan and I know that one of our goals is that every teacher will be familiar with Word, Excel, PowerPoint, classroom presentation stuff." The elementary principal pointed out the continuity in planning,

Well, we have a five-year technology plan and is reviewed fairly frequently. At least once a year and sometimes more often, to make sure were on track and we're headed toward the goals that we intend to be headed toward. We need to make sure that we're doing the things we need to and we're moving in the direction of the technology plans have set (Elementary Principal, 2008, p. 4).

In summary the superintendent believed that professional development was essential to integration technology into instruction. By training staff, he felt he could meet the needs of the learner. He used his technology committee to help develop profession development approaches. The approaches used included training teachers in web pages, electronic grade book, and Smart Boards. The superintendent also used technology to deliver professional development content by modeling with Power Points during in-service training. He was used online instruction to deliver professional development in Indian education.

Technology's Link to the
Superintendent's Political Role

The superintendent believed that school board support was essential to implement technology initiatives, so he thought of approaches to help them learn. The superintendent explained,

One of the things I had the board do, because we concentrated our efforts on web pages. I wanted the board to actually take the time to get in and view teacher web pages. I had my principals one month go in and look at all the teachers sites they're responsible for and choose one that was the best. We gave them an award at the board meeting for that, the next month. I had board members select what they considered to be the best website. That way they were able to get in and see what good work the teachers were doing (Superintendent, 2008, p. 12).

The chairman commented on challenges facing the superintendent, which may become political, "... the superintendent and I, as chairman, communicate all the time, he'll call me and say we're having this problem, you know this is what I would like to do, and then he will say, well, I will bring this to the whole board on an agenda item or whatever it [the approach] is..."

The superintendent engages the trustees with learning experiences according to members of the technology committee, "I think they were the ones that actually promoted the website of the month and gave away the prizes. There was a prize if the teacher's website was picked for a website of the month."

The elementary principal talked about how the superintendent kept the school board current of the technology issues,

Well, the superintendent keeps them apprised for funding and when there are new things we are doing. They're almost always demonstrations of how technology works, maybe 10 or 15 minutes or whatever it takes to display how a smart board works, how an Elmo document camera works, why this program

works, and there's always time for lack of a better term show and tell with the school board so they are aware of what is going on and when a monetary decision is needed of course, we need their authority, so you give them the knowledge, the why of it, and they can make decisions based on that (Elementary Principal, 2008, p. 6).

A technology committee praised the superintendent, “[The superintendent] does a good job of presenting, and keeping the school board informed, and I think that's how they find out most of it. And a lot of them have students in the district so they know what the students are doing all the time.”

The chairman told a story of a board meeting where the technology committee presented requests for equipment. Before the request they provided a report on goals, “...three or six months ago they came to the board meeting and reported on their advancements in what they wanted to purchase to improve things.” A business teacher said,

“The superintendent also has been offering adult education and classes in technology, which I think helps the community see how useful it [technology] is in the classroom. Then when Mill levies and stuff come up, they are more likely to say, we need to get money into those schools, so they can get kids that technology.”

The superintendent used several political approaches to finance technology in his district. The passage of a voted depreciation levy was an approach the superintendent implemented to fund technology on a yearly basis. He explains,

Were lucky enough a few years back to pass a technology levy in the district for \$50,000 per year to be used to replace technology. Without our depreciation levy, our budget would be so tight, and even with that, there is a lot more that we could do, but we have been able with the new construction of the new high school in 2000 put into new computers in all the classrooms.

In reality for years, we operated on donated equipment or got equipment that was old and spent a lot of time fixing. It would break down. There was frustration on the teachers part that, I'm not going to use it because it doesn't

work or broke down. We would end up with new programs needing more memory. It's an ongoing process of trying to stay ahead of that curve and even with the 50,000 a year, we're not doing it. We're trying, but it's still very difficult (Superintendent, 2008, p. 4).

The high school principal talked about the levy,

We do have the special levy for technology. There is some money there, but that usually doesn't cover everything that we need to keep everything up to date. And I think that's why our superintendent is so good. He doesn't waste money on small things, on nickel and dime things or just junk, he waits and does what he thinks is the right thing for the school that will last a long time (High School Principal, 2008, p. 6).

The superintendent used building bond money is to equip the schools during construction of a new school. Infrastructure was included and some equipment. The inherent problem with this approach in the superintendent's words, "So even when you look at the situation of us building a new high school in 2001, we're in 2008 and are we're still using some of those [computers]. So that's the reality of the position schools are in and technology equipment. It is very hard to stay current."

The high school principal said, "What the ideal situation is, what we recommend they [trustees] will support, but if you get somebody on the school board that has a bias towards high school or the elementary, but for the most part the board takes the recommendations from the administration."

The board had approved several approaches to integrate technology into the district. The elementary principal made this point, "He [the superintendent] tries very hard to make sure that the technology stuff is a priority and when people are ready to step up to a new level of technology that he has money available to do that." The

superintendent said, “One example was with our technology payment, because we do get Title II part D money.”

This amounted to \$2,857 during the 2008 school year for the district. It was used for staff professional development activities. Besides the Title II part D Federal funding, the superintendent disclosed the importance of e-rate funding, “The nice thing that the government has done for us in education is the e-rate funding. E-rate funding reduced the phone and internet connection charges for the district during the 2008 school year by \$16,359.43.”

The district had a single general fund budget of \$3,825,557. General fund revenue is based on ANB (average number belonging) and mill levies. The district received \$1,906,012.50 as their share of the ANB base which included payments for Direct State Aid, Quality Educator, At-Risk, Indian Education for All, and American Indian Achievement Gap. General voted levies made up the remainder of the budget. The district does receive Guaranteed Tax Base Aid from the State.

The superintendent talked about grant funding,

Part of technology funding has come with grants like TALES and CHILD. ...TALES (Technology and Learning in Educational Systems) and another one is Project CHILD. Both of them were a consortium of technology training for teachers. We were able to get some new equipment. The superintendent explained the uses of the grants,

Some of those grants helped the technology program and was our way to infuse new technology into schools for teachers. Some technology training was built into the grants. I am happy to say that we have done that. The reality is that we don't have a lot of set aside money for them [instructional staff] to incorporate, along with overall district training (Superintendent, 2008, p. 5).

A teacher pointed out, “Yeah, I see today in the teacher's lounge there is an article about schools wanting more, so it's always about money being an issue.”

The industrial arts teacher is also called the “tech ed” instructor. There is funding specific to his program through the Perkins’s Grant. His program received approximately \$3,000 during the 2008 year, which had been used for equipment and professional development.

The high school principal continued, “He [superintendent] allocates resources for classroom technology on an as needed basis. If they need it, he’ll try to get it for them.” The superintendent approaches the prioritization of needs through the technology plan and requisitions. A technology committee member said, “He sees what monies are left at the end of the year, and tries to match up what the needs are from the technology plan.” In the focus group, the business teacher said,

We as teachers are asked to prioritize too. If she wants a new computer and that is your first priority, we might not be able to get you a new one, but we may be able to get to a refurbished one from the lab or something. I know last year two or three teachers put in for smart boards over the elementary, and they all got them. What we want, we number items one, two or three. We might not always get number one, but we might get two or three (Focus group, 2008, p. 7).

A technology committee member elaborated, “Requisitions are due in February and the budget isn’t due until July. He can kind of see what is set aside, but he uses the plan.”

The high school principal commented on the importance of the technology plan in management in his own words,

Yes, I would say he uses the technology plan as part of the management strategy. And like I said, it’s hard when we had a new high school and three labs are furnished at the same time and all the teachers have new computers at that time, we have found that they all had about the same lifespan ,so then you’re caught seven years later trying to replace 200 computers. So we’ve worked out a system on how we want to replace computers and were getting the schedule down.

You know anytime that money is spent; it has to go to the school board. We make the recommendations and school board approves it.” A technology member in the focus group said, “They have to approve the final budget. And

they have to approve all our requisitions, so they know everything that is being purchased and how it's being used (High School Principal, 2008, p. 5).

Asked if there were any political pressures associated with technology, the superintendent said,

Oh, yeah I have experienced political pressures associated with technology. When you look at the staff and their expectations, and they're right in having expectations that computers should work and I, as a teacher, should not have to worry about a network that's down or computer that doesn't work. When it does break down, that needs to be fixed immediately.

And the hard part is that we have struggled with this fix-it mode. As I said earlier, in the elementary with old equipment, software didn't work, the Internet didn't work correctly, servers went down, and that's been the focus of our district, in the past few years, the internal focus of equipment and not having things break down and replacing the older equipment so there's less of a problem. And I think, we don't have tons of money to hire people to come in. There's so many things to do, trying to keep our head above water, how do you fix it all, while trying to keep everybody happy? We have taken some steps; we've hired a teacher that spends some time fixing computers. Day to day that's the biggest problem we face, is not having the money to adequately and immediately fix technology problems in the district. We've gotten a lot better, but we're still working on the problem of fixing problems on a day-to-day basis. I would say we've made improvements (Superintendent, 2008, p.14).

The Chairman of the board talked about problems, "If there are problems with technology in the district, they work their way up to the board. Those problems are addressed with the board to get that lab fixed, or whatever."

The superintendent uses a familiar pattern of assumptions to solve-problems. The approach according to the Chairman,

At the meetings he would tell us what's going on. He would talk about what problems they are having at the time. So that's how he convinces us. And the technology committee talked about it also. And they thought it would be nice if we had new equipment, so everything could be running right (Chairman, 2008, p. 5).

The superintendent pointed out technology's over-use as problematic to team building and loss of support. In his own words he said,

In the old days one thing that is a plus is that you can meet people face-to-face besides using the technology. If technology has a downfall, I think it relates to the depersonalizing parts of education that don't need to be depersonalized. I am proud that we are small enough that people know people and you can't replace personal contact (Superintendent, 2008, p. 11).

The learning curve can be a problem to support. The elementary principal made the point of overcoming the learning curve, when he said,

Ease-of-use, look and point, I think there would be a lot more use by the teachers, particularly in the 50% to 60% of the lower skilled group, they want it to be easy to use. They don't want to have to work on things, but ... hit the button and there it is. People want things that work. People want things that are effective instructional tools. People want things that are click and use (Elementary Principal, 2008, p. 7).

Superintendent believed a technology coordinator's support solved problems for the teachers using technology. The elementary principal said, "We have a tech coordinator who is directly responsible to him." The technology coordinator was hired to help teachers with technology problems and those who need help over-coming learning curves with technology. The technology coordinator described his background,

Well, I actually went to Montana Tech up for computer programming. I like computer programming, but that it wasn't my idea of a good job. I didn't like sitting around looking at code all day. I don't know if you've done much with computer programming, I just couldn't see doing that day in and day out. So then I enrolled in a Cisco CNA (certified network associate) program and that was the actual networking stuff. So I got my CNA certificate (Technology coordinator, 2008, p. 1).

From the field note observations of the technology coordinator:

Following him across the hall into a computer lab, and then into a long closet shaped room hosting the network server, he understood the hundreds of wires, neatly organized from the ceiling to a series of routers connected to the server. The technology coordinator sat down at the display and began explaining what he was doing, in his words,

What happened was about two weeks ago we got a couple of viruses into our network that ended up attacking our exchange server. So our server sent out a

bunch of spam messages. I mean it was just sending out a ton of spam messages through our exchange server! This is the host for our e-mail. So what happened was that we ended up getting blacklisted on a bunch of spam filtering sites. So there was like a whole bunch of different e-mails that we appeared to be sending out. Other hosts thought that we were spamming. So we had to go through and work on getting taken off those lists to fix our problems. And then we were hit again this weekend and it actually took down our sonic wall filter, which is actually a hardware firewall, which is actually our block between the outside world and our network. What happened is it actually reached over 9000 connections and our server shutdown. After that nobody could get out and nobody can get in, so we had to come in and do that. Right now we have 291 computers and that's about how many connections we should have on our network. So right now what I'm doing is double-checking. I can run another scan on the exchange server and see if I can have picked up anything else. And so far it hasn't found anything else. So the other thing I'm checking here is ongoing through (He reads off IP addresses.) that's our exchange. So I put a block on, so I was the only one that could send or receive e-mail from the outside world and so its priority 6, 7, 8, 9, and 10. So I can do a good log and see if it's denied any on those, but it's only hitting on 28 and that's our generic block so that's okay. So it looks like we've got a problem solved for now. I think we've got our problem taken care of. We'll see if the exchange pops up with anything. So far so good but it's still in that exchange folder.

He said he received an email alert over the weekend on his Blackberry that the network had crashed. He held up his Blackberry. At that point he received a call from a teacher, who needed a power cord for a projector connected to her computer. The lights went out, the door locked, and we headed down the hall to the teacher's room. Another teacher grabbed his arm as he was going by and needed help with a laptop for a substitute in a math class. He said he would be back. Millions a bytes and bits were transmitted during the walk to the districts increasingly demanding users, but new equipment in the elementary was a relief (Anderson, 2008, p.16-17).

The technology coordinator said,

I can get my e-mail messages on the go. I can actually do quite a bit on it. You can download GPS stuff on it, but little things I'd wanted was a good keyboard on it for typing because one of the biggest things in my job is when you walk the hallways and somebody says, "Oh I need this or that" and if you don't write it down. It's just too easy to forget. So, if I have my phone, I usually remember to write it down. I try to make sure that everybody e-mails me so you have a copy to go back on when you forget, you know if you're thinking about something else, it's pretty easy to forget. But the added benefit of this, is that it does get me my e-mail (Technology coordinator, 2008, p. 2).

Summary

The superintendent used technology approaches to make his management operations efficient. Technology had specific purposes in the superintendent's management roles. Although it was not a completely paperless office, technology was the preferred management approach used for district accounting, student records, and communication. The district accounting efficiencies were characterized by a single office clerk. Warrants, invoices, and reports were electronic. Recent changes in student tracking statewide required new learning in the district office. Closer connections to Montana's Office of Public Instruction occurred because of technology. Student NCLB test data was available from OPI's web site. Teachers had access to data for improving student achievement with I-analyze. Teachers were able to access requisition forms, leave forms, and reimbursement forms from district web pages.

The superintendent increased management capacity by training teachers in web page authoring. With the skills and ability to communicate with the web, new connections were made with parents, who had access to their student's grades, assignments, school news, and calendars. Students had access to their grades and assignments, which kept them informed. The public had access to school information. This increase in capacity increased efficiency. A technology committee was used to plan technology training, hardware, software, and resources. The technology plan was used to manage the district direction and budgets. The shared values of the committee modeled values for the organization.

The superintendent's belief that student learning preferences had been influenced by technology in students' environments created an assumption of importance to adapt technological approaches into instruction. The superintendent believed technology motivated students to learn; therefore, technology was encouraged to deliver content across-the-curriculum and across grade levels. The superintendent believed technology in instruction should be relevant to students' real-life experiences. He also believed technology instruction would help the students in their later world-of-work. These beliefs lead to approaches to train teachers in technology.

The superintendent's political role was influenced by technology through several approaches: (1) constant communication with the board chairman, (2) technology demonstrations at school board meetings, (3) teacher presentations, (4) awards for web sites, and (5) visible lessons using web pages by teachers and administrators. He used Power Points to teach stakeholders. He posted information on web pages. He organized a technology committee. He increased capacity in shared values by offering adult education in technology.

Technology was an integrated tool used by the superintendent in his managerial, instructional, and political roles to increase efficiency to improve schools and increase student achievement.

Reflections of Pilot Research

The pilot case study superintendent introduced concepts about learning preferences of students. Logic dictated the connection of instruction with these learning

preferences to help students learn. Additional research in brain research was done as a consequence and added to the literature.

No Child Left Behind influenced the technology plan in the fact that it aligned standards with content. Content delivery with technology was a key point because of the motivation factor for students. If, in fact, students' learning preferences have changed because of the influence of technology in the digital culture, instruction with technology may benefit student learning in traditional settings.

The importance of NCLB may be further explored in the case study. The superintendent never credited technology for improving scores on MonCat II State tests. Although state technology data bases were considered important to teachers for preparing students for the tests, the superintendent considered future preparation of students as a greater importance.

The new Smart Board technology was effective delivering math content in the geometry class. As an observer, I followed instruction of surface areas of triangles in a tetrahedron because of the large graphics displayed. The ability to interact with the technology appeared to be very effective in the elementary content delivery.

Learning management software could be daunting for new superintendents without professional development or contextual training. Like teachers being introduced to new technologies, superintendent's who move into districts will have a learning curve to make the technology efficient. Until the superintendent is comfortable with the management software, the learning curve will compromise efficiency. The pilot case study gave the researcher a chance to practice interviewing, scheduling interviews,

observing, taking field notes, and finding artifacts. The practice writing descriptions was also valuable. The case study will benefit from the testing of the researcher's data collection tools and confidence in collecting data. The efficiency of the research should cause little disruption in the case study's school or any cause for concern.

The pilot case study built a confidence that trust could be established to collect meaningful data to answer the research questions regarding the assumptions superintendent's with high reputations hold in their managerial, instructional, and political roles.

APPENDIX B

TABLE OF SPECIFICATION FOR METHODS
AND SOURCES OF INFORMATION

Table 9. Specifications for Methods and Sources of Information.

Research Questions:	Methods and Sources of Information
(1) What assumptions guide technology approaches in their political roles?	Interviews with superintendents Interviews with principals Interviews with technology committee Interviews with board chairman Examination of school web site Examination of technology communication Examination of student handbook Examination of faculty handbook Examination of policy book Observation of school board meeting
(2) What assumptions guide technology approaches in their instructional roles?	Interviews with superintendents Interviews with principals Interviews with technology committee Interviews with teachers Examination of technology plan Examination of teacher evaluation tools Observation of computer labs Observation of classes
(3) What assumptions guide technology approaches in their managerial roles?	Interviews with superintendents Interviews with principals Interviews with school clerk Interviews with school secretary Observations of superintendent Observation of teachers Examination of inventories

APPENDIX C

TABLE OF SPECIFICATIONS FOR SUPERINTENDENT
INTERVIEW QUESTIONS

Table 10. Specification for Superintendent Interview Questions.

Research Questions:	Interviews Questions: Superintendent
(1) Descriptive Questions	(1) Can you tell me about yourself and your experience with technology? (2) Tell me about technology in the school system.
(2) What assumptions guide technology approaches in their instructional roles?	(1) Can you describe the role of technology in the process you use to improve student AYP achievement? (2) What technology approaches do you like to see in the curriculum? (3) How do you decide what technology training opportunities to provide for teachers? (4) Does technology play any other role in student achievement than helping meet AYP? (5) What technology do you vision in the future of the curriculum?
(3) What assumptions guide technology approaches in their managerial roles?	(1) Describe what you consider is an effective fiscal management system? (2) How have you managed change caused by technology for staff members? For yourself? (3) How is technology used to manage district finances? (4) How do you use technology to manage students' records?
(4) What assumptions guide technology approaches in their political roles?	(1) What political processes are included in technology decisions? (2) Can you describe the most important technological decisions made in the district? a. Have you always agreed with the technology decisions? b. Have others always agreed with the technology decisions? (3) What is the most interesting technology approach being used in the district? a. How was it implemented? (4) Does the community support all of the technology approaches in the district? (5) If stakeholders had ideas to improve technology use in the district, what process would be involved to get it done? Have you ever experienced any political issues or pressures associated with technology?

APPENDIX D

TABLE OF SPECIFICATION FOR PRINCIPALS AND
BOARD CHAIRMAN INTERVIEW QUESTIONS

Table 11. Specification for Principals and Board Chairman
Interview Questions.

Research Questions:	Interview Questions:
(1) Descriptive Questions	(1) Describe the technology vision in the school? (2) What are the goals of technology in the district schools? (3) How does the superintendent clarify expectation of technology use? (4) What does the superintendent do that makes the system run smoothly? (5) Add to the map
(2) What assumptions guide technology approaches in their instructional roles?	(1) What does the superintendent do to ensure teachers are knowledgeable and skillful in technology? (2) How does the superintendent allocate resources for technology? (3) What does a staff member do to have their technology upgraded? (4) How does the superintendent measure the outcomes and effectiveness of technology? (5) How does the superintendent use technology to improve student achievement?
(3) What assumptions guide technology approaches in their managerial roles?	(1) How has the superintendent helped staff transition through new technology? (2) How does the superintendent use technology to help the school be more efficient? (3) What does the superintendent do to help every student access technology? (4) How does the superintendent link technology to learning goals?
(4) What assumptions guide technology approaches in their political roles?	(1) Who is on the technology committee? (2) How does the superintendent instill a sense of social, ethical, and legal issues surrounding technology? (3) What are the action strategies the superintendent uses to establish technology commitment? (4) How does the superintendent communicate the challenges for technology resources? (5) Are there any needs?

APPENDIX E

TABLE OF SPECIFICATIONS FOR OBSERVATIONS

APPENDIX F

ESTIMATED TECHNOLOGY BUDGET 2007-2008

Table 13. Estimated Technology Budget 2007-2008.

HESD 4 District Information Technology Plan

**Estimated Technology Budget 2007-2008
School Year**

Category/Item	Total Cost	Erate Funds	District Funds
Telecommunications Services	\$ 20,816.00	10,108.00	\$ 10,708.00
Voice (POTS plus LD)	10,208.00	5,884.00	5884.00
Cell Phone Service	1558.00	779.00	779.00
Internet	5,700.00	2,850.00	2,850.00
Internet Filtering	600	0	600
Web Hosting	2750.00	1375.00	1375.00
Hardware	\$118,100.00		\$118,100.00
Servers	10,000.00		10,000.00
Clients	80,000.00		80,000.00
Peripherals (printers, scanners, etc.)	1,500.00		1,500.00
LCD Projectors	12,000.00		12,000.00
Interactive Whiteboards	9,600.00		9,600.00
Misc. Hardware (upgrades and replacement parts).	5,000.00		5,000.00
Service Contracts	\$ 7,513.00		\$ 7,513.00
Phone and Wire Plant Maintenance	3,084.00		3084.00
Data Equipment Maintenance	4429.00		4429.00
Non-Contract Maintenance	\$ 69,600.00		\$ 69,600.00
Network Maintenance	500.00		500.00
Server Maintenance	1,000.00		1,000.00
Client Maintenance	2,500.00		2,500.00
Supplies	900.00		900.00
Electrical/HVAC Upgrades	3,315.00		3,315.00
Data Network Upgrades	51,385.00		51,385.00
Software Licenses	4,000.00		4,000.00
Software Maintenance	6,000.00		6,000.00
Professional Development	\$ 55,000.00		\$ 55,000.00
Seminars/Training Costs	8,000.00		8,000.00
Professional Conferences	15,000.00		15,000.00
On-Site Training	2,000.00		2,000.00
Technology Curriculum Coordinator/ Training Specialist (.5 FTE)	25,000.00		25,000.00
Release Time for Teachers	5,000.00		5,000.00
TOTAL BUDGET	\$271,029.00	\$10,108.00	\$260,921.00

APPENDIX G

TABLES FOR THEMES AND MULTIPLE
SOURCES OF DATA

