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Teacher perceptions related to technology tools for curriculum alignment: a survey of teachers' response to a curriculum mapping tool

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TEACHER PERCEPTIONS RELATED TO TECHNOLOGY TOOLS FOR CURRICULUM ALIGNMENT: A SURVEY OF TEACHERS' RESPONSE TO A CURRICULUM MAPPING TOOL

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ABSTRACT

The intent of this descriptive study was to build understanding about the tools, methods and theory behind teacher use of a technology-based tool and process to align K-12 curriculum with state standards. A shift to a standards-driven education policy has created conditions in which teachers are encouraged to align classroom instruction to designated content standards but currently educators lack methods, guidance and appropriate strategies to accomplish this task. Curriculum mapping software is one tool that has been developed to aid in this endeavor.

Data from an existing survey instrument was utilized to analyze subsets of teacher perception data and to perform a factor analysis to study the tools, methods and theory of the curriculum mapping process. The research addressed the following three research questions:

1. To what extent are teachers able to use the TechPaths curriculum mapping software in order to create instructional units of study that are internally aligned with prescribed content standards in a northwestern state?
2. To what extent do teachers using TechPaths report increased understanding about how instruction aligned to standards improves practice and influences student achievement?
3. What are the factors that represent the underlying constructs of curriculum mapping and how do they correspond to the elements of organizational change presented in the conceptual framework?

The researcher analyzed quantitative results of the survey data and the factor analysis and found that teachers appear to be using the software tool to organize and manage curriculum. While engaging in the method of curriculum mapping it appears teachers are reporting that their instruction is aligned to state content standards. An initial theory about the process of curriculum mapping appears to indicate that teachers need support and communication from administrators about the purposes and processes of curriculum mapping. Teachers need additional tool training in order to utilize advanced software features that may facilitate the production of data reports to be used in collegial conversations about curriculum.

Chapter 1

Introduction

This study seeks to understand more about the tools, methods and theory behind teacher use of a technology-based tool and process to align K-12 curriculum with state standards. A shift to a standards-driven education policy has created conditions in which teachers are encouraged to align classroom instruction to designated content standards. High stakes federally mandated tests are based on content knowledge related to the state content standards (Finn, Julian, & Petrilli, 2006; Marzano & Kendall, 1996; Peters, 2004; Ravitch, 1995; Rudalevige, 2003). It is understandable that learning communities are seeking ways to insure that curriculum and the instruction of that curriculum are aligned with state content standards. As a result, new tools are being developed to aid in this endeavor. Curriculum mapping software is one of these tools.

Background

Curriculum alignment is not a new concept, but an emphasis on standards-based testing and student achievement has created more interest in alignment because an aligned curriculum is one of the factors associated with increased student achievement (Kercheval & Newbill, 2000; Sammons, Hillman, & Mortimore, 1995; Schmoker & Marzano, 1999). An aligned curriculum is one strategy educational communities are seeking to achieve school improvement to meet federal accountability measures of No Child Left Behind (NCLB). This legislation mandates a variety of measures to ensure that all students in schools across the nation receive an adequate education. One of the most daunting challenges for schools is the requirement that all students meet proficiency requirements on federally mandated tests by 2014. On a yearly basis, states must administer federally approved tests to students in grades three through eight and in one grade at the high school level in the areas of math and reading (U.S. Congress, 2002, p. 26).

As part of an effort to assist schools with the process of aligning instruction with content standards, a state Department of Education provided grants to 96 of the 168 school districts in a northwestern state for the purpose of engaging in curriculum mapping to align curriculum with instruction in order to improve student achievement (Pogany, 2005). The following section is a scenario to provide a detailed example of how this technology is used by teachers in schools

A Curriculum Mapping Scenario

After consulting the research related to the importance of curriculum alignment, a curriculum mapping leadership team has been established in the Prairie Winds School District. The leadership team has decided that teachers in the school district will begin the mapping initiative by using curriculum mapping software to complete a projection map. A projection map allows teachers to project classroom instructional activities over the course of the proceeding school year. The leadership team could have also chosen for district personnel to create a diary map in which case they would have recorded information with the curriculum mapping software after the instruction had been conducted in the classroom. Even though district personnel have chosen a projection map as a way to begin the process, they will continue to adjust the projection maps during the school year to reflect the actual taught curriculum. The entire group of maps from all district staff will represent the actual journey through that school district in that particular year. This data will represent the taught curriculum and can be used as a data set in contrast to assessment data that represents the learned curriculum.

Mr. Kimbo has experience in interpreting assessment data because the Prairie Winds School District has been conducting data retreats each year to gauge student progress and make adjustments to instructional priorities. He is interested to see how the addition of curriculum map data will influence district-wide instructional decisions as well as individual classroom instructional decisions. He will enter his curriculum data into the software which is a relational data base. He sits down with his Tablet PC and logs on to the web-based software. He begins to make a calendar-based curriculum map for his Biology I class. He starts by going to August and naming the first instruction unit he will teach during that month. He names the unit cell division and then moves his cursor to the standards column to choose the standard that will guide this instructional unit. He will build the map by entering the related content and skills required to meet this standard in the appropriate column. See Appendix A for a screenshot of the hypothetical map created by Mr. Kimbo. Next he will define the parameters of the assessment that will measure the skills and content. He may choose to add essential questions that will help pique student interest and focus learning in this instructional unit. Finally he will design the instructional activities or lessons that will bring students into meaningful contact with the content and skills they need to master the standard. As Mr. Kimbo builds this instructional unit online, he is free to choose whatever instructional resources meet his needs. He is not bound to the structure of a textbook or to a scripted curriculum. However, he may choose to use a textbook as one of the many resources in the unit. At the completion of the instructional unit, Mr. Kimbo reflects on the elements he has entered in each column to ensure that this unit has internal alignment; the instructional activities meet the instructional goals as defined by the content standard.

Because Mr. Kimbo has entered the curriculum data online, the Biology II teacher Mrs. Gladstone can look to see what students will learn in Biology I, so that she can accurately plan for continuation of Biology II. In this way the science department reduced gaps and redundancy. In a similar fashion, the general science teacher can look at Mr. Kimbo's map to see how she should prepare students for success in advanced science courses.

When all teachers in the Prairie Winds School District have mapped the curriculum, they can meet to read each other's maps and offer feedback about quality and internal alignment. They can share information, devise strategies for meaningful integration of subject areas, gain insight about student learning and make curriculum adjustments to potentially improve the K-12 experience.

Statement of the Problem

Thousands of teachers in all fifty Unites States are attempting to improve the alignment of curriculum and instruction to standards. This effort is due largely to pressure to perform well on high stakes tests that are aligned to standards (Daggett, 2000; Lauer et al., 2005; Popham, 2001; Webb, 2007). Currently there is little research or empirical evidence to help the educational community understand the tools, methods and the theoretical framework of the tools. Teachers have been given a mandate to align curriculum but have not been provided with tools or strategies to fulfill the mandate. Because the entire curriculum of a K-12 districts consists of massive amounts of data, technology tools may be able to assist in managing this data. When people can share information in a meaningful way they can increase their knowledge based on interaction and experience with the information (Petrides & Nodine, 2003). There is not a practical way to share knowledge about the curriculum in a district without using technology. The acquisition of and the training required to incorporate new technology tools into practice requires a significant amount of time and money. To be effective, the addition of tools in a learning organization must be accompanied by methods and theories that support tool use. (Senge, 2000; Senge, Ross, Smith, Roberts, & Kleiner, 1994). It would be useful to understand more about the alignment tool of curriculum mapping in this context.

Conceptual Framework

School systems are continuously implementing programs and processes to improve education. These programs and initiatives are often dropped just as quickly as they are implemented resulting in an endless cycle of initiatives that cause educators to lose faith in anything new (Schlechty, 2001). This study examines a curriculum mapping software tool, the method of using that tool and the theories that may underlie teacher use of the tool. The lens for viewing these components will be the organization change model illustrated by Figure 1. The model situates tools, methods and theory in relation to the other interacting variables of organizational change.

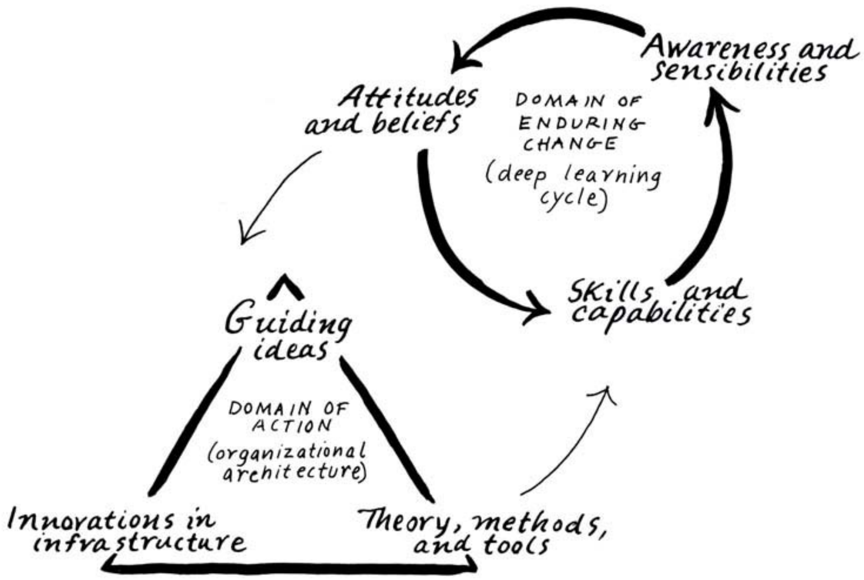


Figure 1: Interaction of the triangle of organizational architecture and the deep learning cycle (Senge et al., 1994, p. 42). Reproduced with permission of the author.

Deep learning cycle. The circular structure at top right illustrates the deep learning cycle or domain of enduring change and consists of three interrelated parts (Senge et al., 1994). It is represented by a circular shape because learning is a continuous and fluid process without abrupt starts and stops. One indicator of deep learning is an acquisition of skills and capabilities. As these develop, new awareness and sensibilities develop to alter views of structures or behavior. These new views gradually result in new attitudes or beliefs (Senge et al., 1994). An example of a deep learning educational scenario helps make sense of this cycle. For instance, special education policy has dramatically changed since the 1970s. Prior to the mid-1970s, disabled and mentally retarded students were segregated from the general student population. As educators gained skills and capabilities in working with disabled and mentally retarded students, awareness and sensibilities about the most suitable learning environment for these students changed, resulting in new attitudes and beliefs. Eventually the deep learning cycle influenced the organization architecture which resulted in new ideas about the least restrictive environment for learning and in structural innovations like inclusive classrooms, new laws and increased funding for special education.

The deep learning cycle and changes in organization architecture do not happen easily or quickly, but when they do happen, the result is deep and lasting change. In the case of special education, the change resulted in federal legislation which forever changed the administration of special education. The challenge for the educational organization is figuring out where to exert influence to affect the deep learning cycle (Senge et al.). Which initiatives, professional development models, software, programs, textbooks, training programs or certification programs will promote the skills and capabilities to set the learning cycle in motion?

Organizational architecture. The deep learning cycle does not exist in isolation; it is influenced by the organizational architecture or domain of action. In the deep learning cycle model the educational organization is represented by the triangle with each point of the triangle consisting of a different element. Guiding ideas reside at the top of the triangle and can be purposefully articulated, developed and communicated in a learning organization in the form of a vision or mission statement. These artifacts convey the purpose of an organization or institution and give everyone in that organization a sense of direction (Senge et al., 1994). For example, if educators in a school district believe all children can learn, this belief may influence day-to-day behavior and serve as a guiding force for long term goals. Using the special education scenario, the deep learning cycle may influence the development of guiding ideas in that all children can learn, even those with mental or physical limitations.

Two distinguishing features of guiding ideas are that they must have philosophical depth and they cannot remain static (Arbuckle, 1994). Philosophical depth is crucial because the ideas must be meaningful and enduring to be valued. Value is maintained when guiding ideas are continually evaluated so they don’t become stale and irrelevant. When many players in the learning organization have input in the process of evaluating guiding ideas, they become a shared vision (Kotter, 1996; Senge, 2000; Senge et al., 1994).

Theories, methods and tools. Theories, methods and tools are identified on the second point of the triangle and the acceptance of these can be greatly influenced by guiding ideas. This study is primarily concerned with this aspect of the conceptual framework. When these elements are introduced in a learning organization they may be congruent with guiding ideas or they may be in conflict with guiding ideas. Eventually, the theory, method or tool will fail because it does not match the guiding idea, or the guiding idea will be altered to allow for integration of the new theory, method or tool. In educational realms, theories, methods and tools are the most common entry point where organizations attempt to influence organization architecture (Senge, 2000; Senge et al., 1994). Senge et al. refers to the thinking of Buckminster Fuller who said you shouldn't bother to change the way people think, you should give them a tool and that will pave the way for new thinking. The relationship of theories, methods and tools is in itself a complex arrangement. Sometimes a new tool or method will test a theory and create conflict which may result in an altered or improved theory. In other cases the tool or method may change to better match the prevailing theory that is more congruent with guiding ideas (Senge et al.).

Tools must be congruent with an underlying theory otherwise the tool may reproduce results in one situation, but not in another and there will be no feasible way to determine why. This might be the situation if educators used a tool for a method it was not intended. This study will seek to illuminate information about the teachers' response to using technology as a method of curriculum mapping.

In the case of learning environments, the tools must be grounded in theories and knowledge about learning and teaching. This study will seek to explore teachers' responses to a survey that may begin to offer insight into the theories that undergird the use of curriculum mapping tools and processes. Additionally some people may be able to use the tool well, while others will fail. This study will assess the use of the curriculum mapping tool used to align curriculum with state content standards by teachers in a northwestern state. Without underlying theory, tools may be used for purposes they were not intended. Without the deep guiding ideas behind the tool they are in danger of being grabbed at will for an unrelated problem (Arbuckle, 1994; Senge et al., 1994). Senge concludes a lengthy discussion on tools by stating that the most important reason tools must be supported by theory is that without deep purpose the tool may solve an immediate problem, but it may not cause transformative change. In these cases a tool may actually mask a deeper problem that will go unsolved resulting in better conditions in the short run, but in the long run, a worse situation may transpire (Senge et al.). By studying the tools, methods and theories associated with curriculum mapping, this study will seek to understand if curriculum mapping is an intervention that has potential to influence interaction of the deep learning cycle and the organization architecture of a school district.

Innovation in infrastructure. Another key to successful introduction of theory, methods and tools is innovation in infrastructure, the third and final point of the triangle. Infrastructure must support people in doing their work. In the case of special education, federal legislation facilitated changes in infrastructure that resulted in funding to support special educators and modified schedules for special education students to allow for inclusion in regular classrooms. Infrastructure may also include managerial support, time, location, funding, data, information sources, and collaborative time with colleagues. For new tools, methods or theories to be successfully introduced there must be a change or innovation in infrastructure to support the new activity and the learning that comes with the new activity (Senge et al., 1994). A hypothetical example of changes in infrastructure related to this study might be that educators need designated time to understand the theory of alignment and situate this new learning within guiding ideas. They also need professional development services to learn methodology so they understand the process of aligning curriculum to standards. If the tool is alignment software, this also requires an expenditure of money to purchases as well as training time to allow for proper use of the tool. Implementation of an alignment tool or any other tool may also include reflective and collaborative time for teachers in the same school to discuss the practice which may in turn influence and alter guiding ideas. These are examples of possible innovations in architecture necessary to support the other points of the triangle.

In order to develop learning organizations all three points of the triangle need adequate attention. When there are guiding ideas there is purpose and a general sense of direction. With proper tools, methods and theories people can launch new skills and capabilities which spur the conditions for deep learning. With appropriate innovations in infrastructure, guiding ideas and powerful tools, innovations have the support necessary to grow and become integral to practice in the organization (Senge et al., 1994).

An example of application of the conceptual framework. Arbuckle (1994) applies the deep learning cycle theory in her work to influence culture in schools, specifically in the context of developing professional learning communities. In this scenario the school culture, which is not a static entity, but rather something that is constantly influenced by the three elements shown, is represented by the circular figure. The culture can be influenced by the domain of action. This is the place where leaders can exert influence to alter culture. The triangle in figure 2 represents three possible entry points for this influence. Action could come through influence on guiding ideas, alterations to organizational arrangements or through the use of new methods and tools.

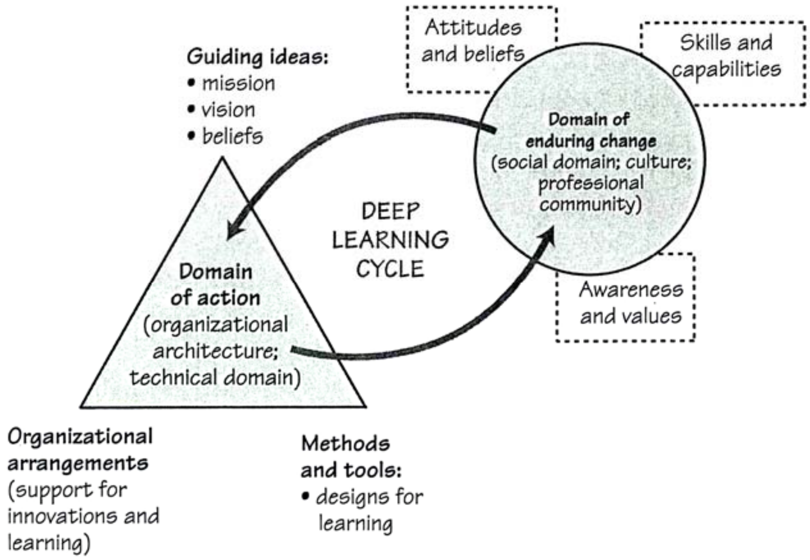


Figure 2: Interaction of domain of change and domain of enduring change (Arbuckle, 1994, p. 327). Reproduced with permission of the author.

For school organizations to grow and learn, all three corners of the triangle should be cultivated. Arbuckle (1994) elaborates on tool use in schools saying tools are vital to the development of a learning community in schools and classrooms. Tools can fulfill three essential and broad roles. The first of these roles is assisting school communities and individuals within those communities in aligning actions to goals for the purpose of creating change that is wanted by the community. The next role of tools is to enable reflective conversations that bring patterns of behavior to light, reveal underlying assumptions and help the group develop capacities for conversation that are inquiry-oriented. The final and third role of tools is to help communities conceptualize complex issues (Arbuckle, 1994).

Purpose of the Study

The purpose of this study is to understand more about the introduction of curriculum mapping software, a technology-based tool educators use to align curriculum to state standards. Although this study is situated within the larger framework of the deep learning cycle, for practical reasons it will be limited and focused on one aspect of the triangle's structure, theory, methods and tools (Senge et al., 1994). Using the conceptual framework presented in the last section, the tool in this study is the curriculum mapping software. The method is the specific procedures related to the curriculum mapping process that allow for internal alignment within instructional units. The theories that undergird use of the tool and method will be explored further in the research, but an assumption that guides this exploration is that an aligned curriculum improves student achievement. See Figure 3 for a theory of how tools, methods and theory interact with the organizational architecture and the deep learning cycle. The tools and methods are bound within theory which is represented by the infinity symbol because these three elements are always in flux. Ideally tools are not used haphazardly, there is a method for their use and there is some underlying purpose or theory for using them.

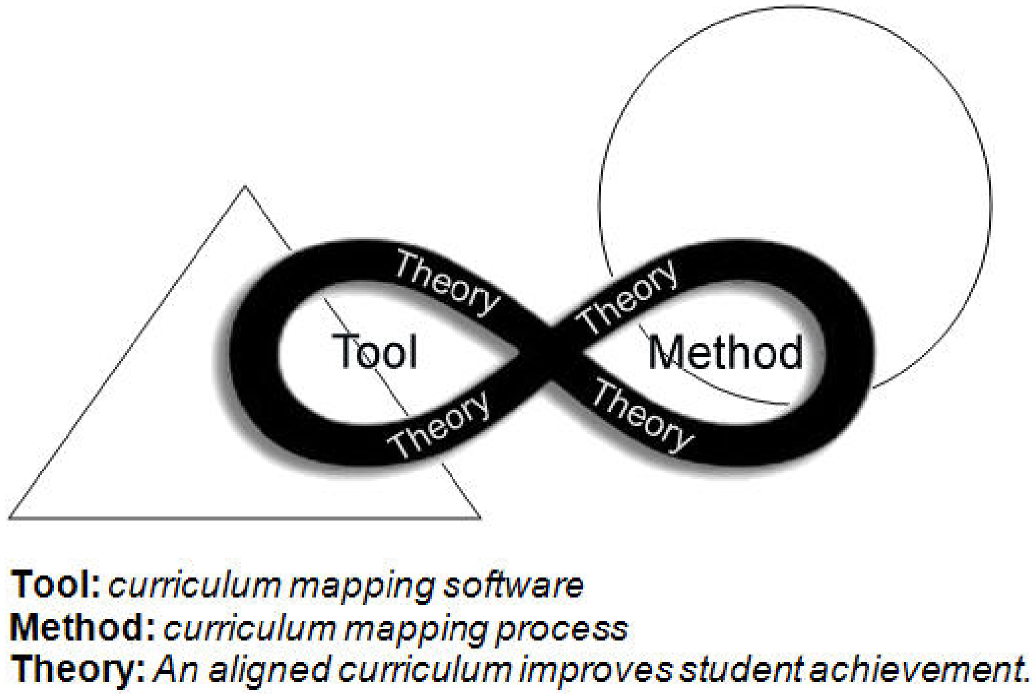


Figure 3: Interaction of domain tools, method and theory. Original graphic produced by the author.

The research questions that guide this study correspond directly to the conceptual framework in the following manner. Research question one addresses tool use. Research question two is intended to inform the method. Research question three applies to the theory.

Research Questions

1. To what extent are teachers able to use the TechPaths curriculum mapping software in order to create instructional units of study that are internally aligned with prescribed content standards in a northwestern state?
2. To what extent do teachers using TechPaths report increased understanding about how instruction aligned to standards improves practice and influences student achievement?

3. What are the factors that represent the underlying constructs of curriculum mapping and how do they correspond to the elements of organizational change presented in the conceptual framework?

Research Design

Existing survey data will be analyzed to describe the use of curriculum mapping software tools and curriculum mapping methods as part of the implementation of a curriculum mapping initiative in schools in a northwestern state that utilized TechPaths software. Factor analysis will be conducted to develop the theory that undergirds use of the associated tools and methods.

Definition of Terms

Curriculum. Curriculum is a plan for learning that is specific and derived from a desired result (Wiggins & McTighe, 2005). This plan is the vehicle educators use to manifest goals for student learning and it defines expectations for student learning during the school experience (Danielson, 2002).

Alignment – is the arrangement of a group of scattered elements so that they are oriented to function as a whole with a common purpose (Senge, 2000).

Content Standards. Content standards are specific to an educational curriculum and are intended to provide clarity about the specific knowledge and skills that educators should deliver in the classroom and what students should be expected to learn. Standards should be measurable so that when students demonstrate the knowledge and skills associated with the standard they can be given accurate feedback about how close they are to mastering the content standard (Ravitch, 1995).

Curriculum mapping. Curriculum mapping is a process where individual educators document the taught curriculum in order to share and analyze each other's curriculum maps for the purpose of creating a coherent and consist curriculum across a school district that is aligned to standards and responsive to student data (Jacobs, 1997; Udelhofen, 2005).

Limitation of the Study

The existing data set was used in the study was collected from public school districts in a northwestern state that choose to engage in the statewide curriculum mapping software initiative. Only teachers in schools using TechPaths curriculum mapping software were included in the study.

Significance of the Study

This study will be useful to school districts who are currently engaged in curriculum alignment processes with TechPaths. It will be useful to state departments of education who are considering a statewide curriculum alignment initiative using this technology. Finally, it will be useful for teachers who are currently engaged in alignment activities because they will have more evidence to support or refute the use of TechPaths alignment tools and processes.

Organization of the Study

This study is organized into five chapters. The first chapter describes the problem and provides a conceptual framework to ground the work. The second chapter reviews the literature related to curriculum, content standards, alignment and technology use by teachers. The third chapter of this proposal provides information about the research methodology used to conduct the study. The fourth chapter provides results of the study and the fifth chapter provides a discussion of those results.

Chapter 2

This review consists of three main sections. The first section addresses the status of standards-based curriculum. The second section pertains to curriculum alignment. The third and final section conveys information about technology tools related to curriculum design and development.

Introduction to the Literature Review

Schools are ubiquitous institutions in the United States. You can find them everywhere from this nation's most densely populated, metropolitan, culturally diverse areas to remote, rural, homogenous one-room school houses. Although schools were created for the common purpose of creating an educated democratic citizenry, the varying strategies to achieve that purpose are often vigorously debated in political arenas (Cuban, 1993a; Mondale & Patton, 2001; Peters, 2004). Accountability in public education related to educational outputs defined by content standards is currently at the forefront of these political discussions. (Finn et al., 2006; Fuhrman, 2001; Marzano & Kendall, 1996; Peters, 2004; Ravitch, 1995; Rudalevige, 2003) The accountability system is based on three assertions. The racial and economic achievement gap needs to be diminished. Good schools can overcome the effects of poverty on student performance and external pressure through high stakes testing and tough accountability will make schools improve (Petrelli & Hess, 2006).

These high stakes tests are based on knowledge of educational content standards. The standards were developed because of concerns related to equity in student outcomes (Fuhrman, 2001; Lauer et al., 2005; Marzano & Kendall, 1996). The simple task of a standard is to define what students should know and be able to do. One of the goals of the creation of standards is to make curriculum transparent on a national, state and sometimes local level in order to provide all students, regardless of race, gender, religion or socio-economic level with an education that puts them on an equal playing field (Brandt, 1995; English & Steffy, 2001). Schools are attempting to reengineer curriculum to meet the needs of standards-based education.

Standards-based Curriculum

The first section of the literature review includes broad information about the nature of curriculum and the history of curriculum development in the United States. Additionally information is presented about the pressures that have led to the current state of standards-based curriculum.

Curriculum. Curriculum is defined in a variety of ways. A broad definition could include everything that is taught at an institution of learning (Stein, 1988). A high school biology teacher might define curriculum as all the skills and knowledge about biology that students in her class will learn over the course of a year (Danielson, 2002). Some schools might have one path of study or curriculum that is recommended for students who are college bound. They might also have a document that defines the work of teachers and this document could be called a curriculum (English, 2000; Marzano, 2003). In college a student must follow a specific curriculum to obtain a bachelor's degree in business. The etymology of the word curriculum literally means a course to be run (Stein, 1988; Wiggins & McTighe, 2005). In essence a curriculum is the path we take to make our way to some destination; the end of a single class, the end of a grade level in a school year, or the end of a K-12 school program (English & Steffy, 2001). Sizer (1999) says curriculum is the structure that creates order so that priorities can be determined. Danielson (2002) says curriculum is the vehicle educators use to manifest goals for student learning and that it defines expectations for student learning during the school experience.

Frameworks for understanding curriculum. Curriculum theorist A. W. Foshay (1991) developed a matrix of curriculum to clarify the three basic elements: substance, purpose and practice. The substance of curriculum defines what should be taught. The purpose of curriculum defines why it should be taught. The matrix identifies six dimensions related to the purpose of the curriculum. They are intellectual, social, emotional, aesthetic, physical and transcendental. Practice, the third element, helps answer the question of when content in the curriculum should be taught, how it should be delivered, to whom and at what time in the cycle of learning (Foshay). Foshay's stance is not widely accepted because most mainstream curricula focus on the intellectual purpose whereas his ideas represent the ideal and do not take into the many contextual factors of a real classroom; it does not translate well to practice because teachers rarely have time or resources to attend to all six dimensions (Deets, 2000; Goldstein, 1998).

Danielson (2002) similarly breaks down the goals or purpose of curriculum into distinct subunits. They are: knowledge; thinking and reasoning skills; communication skills; social skills; physical skills; aesthetics, dispositions, and ethics. She recommends that curriculum be properly sequenced. Complex ideas should be preceded by more simple ideas so there is a spiraling of the curriculum over the course of the student experience. It is also recommended that curriculum be coordinated and integrated when possible. Students can make more meaning of subjects when they are not taught as discrete units of knowledge. For instance in 11th grade both American History and American Literature can be taught so that students make more sense of the content by making connections between the subjects (Danielson, 2002).

The History of Curriculum Development

English (2000) says that historically curriculum is defined by any plan or document that has the purpose of focusing or making explicit the work of schools and teachers in that school system. These plans are often created by groups of teachers in a school, a school district or at the state level. In public schools in the United States, curriculum is organized around a 19th century structure in that there is a body of content assigned to each of the grades in a school. Students are assigned by age to those grades. At the end of grade eight or twelve, wherever the student chooses to exit, they should come out roughly in the same place as other students in other schools, assuming each teacher and school had done its prescribed job (Eisner, 1995). Wiggins and McTighe (2005) liken curriculum to a blueprint formulated from desired results. They say it should be more than a program guide of topics and materials, but that it should also include the assessments, assignments and experiences that are necessary to achieve the desired learning goals. Schools formalize curriculum in writing so that all participants in the system understand the path to each destination. Jacobs (1997) calls this the written curriculum. There can be variations in how the written curriculum is implemented by different teachers, thus the taught curriculum does not exactly mirror the written curriculum. Ideally everything that is taught would be learned by each and every student, but typically the taught curriculum does not exactly match the learned or tested curriculum. The learned curriculum is reflected in data gathered from assessment results (Jacobs, 2004). English further breaks down the categories of written, taught and learned curriculum into formal, informal and hidden curriculum (English, 2000).

Cuban (1993b) lays out a similar structure to define the subtleties of curriculum but divides it into four parts: official, taught, learned, tested. The official curriculum is that which is defined by governing entities and this is the curriculum to which state-mandated tests are aligned. The taught curriculum is what teachers choose to teach in their classrooms based on past experiences, available resources, content knowledge, interests and preferences. Although the taught curriculum and official curriculum may overlap, often there is not fidelity between the two. In a similar fashion the taught curriculum is not congruent with the learned curriculum. Compared to other explanations of the learned curriculum, this four-tiered structure expands on the definition of the learned curriculum to include more than just what is tested, but also collateral learnings such as those gained from the teachers' and fellow classmates', ideas, work habits, humor and attitudes. These more subtle learnings inform students about how things are done. Finally, the tested curriculum consists of results of national, state, local, district and classroom tests. While these results do overlap with the official, taught and learned curriculum they are narrow and limited (Cuban, 1993b, 1995).

Cuban (1993b) points out that policy makers are not aware of the many layers of curriculum and that their efforts are continually directed at the official curriculum and the tested curriculum when it is clear that this is not necessarily the curriculum that is being delivered or learned by students, thus rendering such reform efforts ineffective. Efforts to reform education should be less focused on the substance of what is taught, but rather directed at improving the quality of pedagogy, student-teacher relationships and teacher attitudes toward student learning. Furthermore, teachers should be equipped with more strategies and more flexibility to create and use their own materials that help connect the official, taught, learned and tested curricula (Cuban, 1993b).

The influence of textbooks. Historically it is not teacher-created materials that have driven student learning, but rather textbooks have largely dominated and driven the curriculum in schools (Apple, 1986; Apple & Christian-Smith, 1991). Apple and Christian-Smith contend that these textbooks are not merely delivery systems for facts and figures, but that they are also deeply influenced by the agenda of the textbook writers and the associated political, cultural, social and economic systems from which these writers are grounded. When a group of teachers, or a curriculum department chooses a new textbook series, their own personal beliefs, culture and learning experiences influence this decision making. It is a concern that textbooks do not represent neutral knowledge, nor are they chosen based on neutral knowledge and these texts greatly influence classroom curricular decisions. From the advent of the first McGuffy Readers, textbooks became synonymous with curriculum. Often a school will adopt a textbook series and it is the content and sequence of activities designated by the textbooks that guide instruction. It is easier for an inexperienced teacher to rely on the order and structure in a textbook rather than consulting district guidelines or state content standards to guide curriculum. Frequently the textbook is not aligned with the other documents that represent curriculum in a district such as state standards, local scope and sequence documents and accreditation guidelines. This creates confusion about instructional priorities (English, 2000; Jacobs, 2004; Ravitch, 1995; Schmoker, 2006; Udelhofen, 2005; Wiggins & McTighe, 2005).

Instructional priorities. This confusion about curriculum is not limited to the classroom. Matters of curriculum in American schools have long been a subject of political debate. The tension between federal priorities, state mandates and the desire for local autonomy is constant (Peters, 2004; Schlechty, 2001; Superfine, 2005). Curriculum decision making is also influenced by the pendulum swings with regards to educational philosophies and approaches (Mondale & Patton, 2001; Schlechty, 2001). Prior to the current focus on testing and outputs in education, there was previously an emphasis on inputs where accountability agencies held school districts responsible for adequate education resources like the numbers of academic courses, appropriate numbers of certified staff, adequate libraries and other resources. Currently, the nation’s educational system is focused on a direct instructional approach with clear emphasis on teaching state content standards. Standards and standards-based reform are the driving force in education policy strategy in this country (Finn et al., 2006; Marzano & Kendall, 1996; Peters, 2004; Ravitch, 1995; Rudalevige, 2003).

A Call for Standards-Based Education

Formal content standards came into vogue in 1989 after 50 governors and President George H. W. Bush adopted National Education Goals for the year 2000 (Finn et al., 2006; Ravitch, 1995). Under the Bush administration the project was called America 2000 and it included the development of content standards. This event was prompted by the 1983 report called *A Nation at Risk*. The report said the American public education system was failing and it called for reform (Gardner, 1983) . Under the Clinton administration America 2000 morphed into the Goals 2000 Act, the next significant event that moved the nation's education system toward standards-based education. Congress passed this act, along with the Improving America's Schools Act putting more money behind standards-based reform (Peters, 2004). Standards underpinned the effort. Standards were created for teacher certification programs, for the outcomes of teaching and for the content of curricula. Nearly every professional organization representing subject matter content areas crafted standards about what students should know and be able to do (Eisner, 1995; Finn et al., 2006).

In 1989, the National Council of Teachers of Mathematics (NCTM) produced standards for math (Buttram & Waters, 1997). This work became the benchmark for other standards-setting organizations. There are recommended national standards for foreign language, social studies, science, the arts and math just to name a few (Lewis, 1995; Marzano & Kendall, 1997). These content specific organizations followed NCTM's lead by developing and defining what is considered essential knowledge and skills for particular disciplines. During the same time period states started to produce their own student achievement standards (Buttram & Waters, 1997)

Today standards in education are pervasive (Buttram & Waters, 1997; Eisner, 1995; Finn et al., 2006; Marzano, 1999; Wolk, 1998). The idea of standards implies rigor and high expectation and thousands of standards have been created for a variety of subjects, but the quality of standards comes under frequent scrutiny. A report by the Fordham foundation says that even though states have been updating and upgrading standards they are still on the whole mediocre. They give the nation a "C-minus", stating that two-thirds of students in K-12 schools in the Unites States are attending schools with standards that rate a C-, D-, or F- (Finn et al., 2006, p. 6). Additionally critics, some of which are ardent supporters of the concept of standards, say there are too many standards and too many that are poorly conceptualized (Brandt, 1995; Eisner, 1995; Popham, 1997, 2006; Schmoker & Marzano, 1999; Wolk, 1998). Marzano (2003) estimates it would take 15,465 hours of instruction to adequately cover the average amount of standards (p. 25). Yet schools, on average, have only have 9,042 of instructional time available during the K-12 experience (Marzano, 2003, p. 25). This dilemma creates a situation where teachers must choose, on their own, what they think is most important and when the target is a mile wide, teachers do not know where to aim their instructional efforts (Jacobs, 2004; Marzano & Kendall, 1997; Popham, 2006; Ravitch, 1995; Schmoker, 2006). When the door to the classroom is shut, teachers can select any lesson, objective and part of the curriculum they decide is appropriate (English, 2000; Schmoker, 2006).

Defining standards. A standard can be something that is established by tradition or consensus. It can also serve as a measure by which judgments, values or decisions are determined, so essentially it can be both a goal and a measure toward the goal (Eisner, 1995; Ravitch, 1995). Ravitch argues that Americans seek standards in almost every aspect of their life. There are standards for manufacturing, construction, medical procedures, food processing and water quality. By their nature, standards are subject to measurement, evaluation and observation. From a global perspective, the purpose of standards it to improve the quality of life, literally improving the standard of living by improving communication and the ability to trade freely. The spectrum of standards is broad and ranges from the informal to the formal.

Schools have highly formalized documents that spell out standards for achievement in each grade level or course. Sometimes these standards are called learning objectives (Popham, 1997). The current standards movement is grounded in a long-term effort to establish what students should know and be able to do. Either formally or informally, explicitly or implicitly teachers plans for instruction with a learning target, objective, goal or outcome in mind (Buttram & Waters, 1997; Ravitch, 1995). The learning goals may be very broad and vague such as – I want my students to know how to be good citizens. Or they may be very narrow and focused – “9-12.C.2.2. Students are able to interpret the meaning of basic constitutional rights guaranteed to citizens”(*South Dakota Social Studies Standards*, 2006). The development of content standards formalizes this process of creating goals for learning and it informs all educators, parents and student about what students should know and be able to do (Harden, 2001; Ravitch, 1995; Schmoker & Marzano, 1999; Wiggins & McTighe, 2005).

Ravitch (1995) acknowledges there are critics of standards and she believes the debate about standards is healthy and good for education. Some find the plethora of standards too restrictive and worry about forced conformity that can squelch creativity and exploration. Others agree on standards in principal, but are disappointed with the standards being produced in individual states (Brandt, 1995; Eisner, 1995; Finn et al., 2006; Marzano & Kendall, 1996; National Commission on Teaching & America's Future, 1996; Popham, 2006). Ravitch (1995) argues that in order to ensure a quality education for all students there must be some minimum standards in place. Eisner (1995) concurs saying, “Without standards, we are condemned to an unbroken journey into an abyss of mediocrity; we will remain a nation at risk” (p.760).

Forty-nine of the fifty states have formalized goals for learning by adopting state content standards. Iowa has chosen to delegate the standards setting process at the district-level rather than the state level, so while they are not included as a state that sets standards, this does not mean they are working outside a policy of standards (Daggett, 2000; Eisner, 1995; Finn et al., 2006; Marzano, 1999; Wolk, 1998). Other organizations provide guidance to states in the form of national standards. For instance, the International Society for Technology Education publishes technology standards (International Society for Technology Education, 2007). States use the national standards as a starting place for developing their own standards related to technology in the classroom (National Commission on Teaching & America's Future, 1996).

Standards are often organized by grade level and subject. For instance a state may have eighth grade social studies standards. Each grade has designated content standards in math, reading and science. Standards are often organized at the state level, usually under the guidance of a department of education. Some local districts choose to supplement or modify the state standards to reflect local values or areas of interest. For instance a school located in an area with specific local customs might supplement state standards with teaching standards that incorporate culture sensitivity into traditional content areas (Ravitch, 1995).

The preceding section of the literature review included broad information about the nature of curriculum, the history of curriculum development in the United States and the pressures that have led to the current state of standards-based curriculum. The next section of the literature review, entitled curriculum alignment, contains information about the concept of alignment, the importance of alignment and current strategies to achieve alignment.

Curriculum Alignment

Alignment means that curriculum is coherent in the sense that curriculum, instruction and assessment are connected in a meaningful and organized way (Senge, 2000). English refers to alignment as the overlap or match between the content of a test and the content of the curriculum (English, 2000). Schlechty (2001) says curriculum alignment assures that what is valued is what gets taught because alignment means the content and skills that are relevant and agreed upon by the community are embedded in the work which students perform.

Internal and external alignment. There are two basic types of alignment, internal and external (Drake & Burns, 2004). Internal alignment happens when the intent and language of standards are reflected in the instructional strategies and the classroom assessments. This means teachers must clearly understand the standards and then design or acquire assessments and activities that bring students into profound and meaningful contact with the desired learning objectives. This sounds like a common sense approach, but too often teachers work from activities that seem to work well with students, but that do not provide a clear end goal (Wiggins & McTighe, 2005). External alignment happens when required testing objectives and standards are aligned with curriculum (Drake & Burns, 2004). This means the standards teachers are using to create internal alignment are also congruent with the state mandated or other mandatory assessments. Evidence of this alignment must be present in both the written and the taught curricula. It is not adequate for the standards or concepts to be written in a district curriculum guide or a scope and sequence guide. It must also be reflected in the taught curriculum (Jacobs, 2004).

Internal alignment can be broken down into more categories. There is instructional alignment, vertical alignment and horizontal alignment. Teachers create conditions for instructional alignment of units of study when the content, skills, assessment and lessons in a particular unit of instruction are built in accordance with the goals of the learning unit which is often defined by a content standard. Internal alignment can also mean there is horizontal fidelity across a grade level. An example would be all third grade teachers getting together in a particular school to make sure the essential content and skills in the third grade curriculum are delivered with consistency at that grade level. Vertical alignment insures fidelity of the delivery of content and skills in successive grade levels. If a curriculum has vertical alignment teachers from grades three, four and five, as an example, would get together to make sure there are no gaps or redundancies in what gets taught at those grade levels. Vertical alignment would help to ensure a smooth and sensible spiraling of curriculum (Jacobs, 2003, 2004; Udelhofen, 2005). This research study is focused on the internal alignment of instructional units of study.

Concepts for curriculum alignment. Two ways to align curriculum are frontloading and backloading. When teachers align with a frontloading method they design their curriculum first and then search for or write a test that matches the design (English, 2000). For instance, a teacher might spend a week lecturing about the anatomy of the frog, engaging students in activities related to the anatomy of a frog, and then the teacher would sit down and write an assessment that will test the students' knowledge related to the learning unit. This scenario is not atypical and English (2000) describes it as being the universal preferred practice. There can be problems with this method if teachers are not skilled at assessment development or in matching the test to stated objectives. Teacher A and Teacher B might engage in similar units related to frog anatomy, but one might write an assessment heavy on rote memorization of frog parts, while another might assess how students relate knowledge of the frog body systems to human body systems.

When teachers engage in backloading, they start with the assessment in mind and design curriculum to match the content of the assessment (English, 2000). Given the current testing climate, this method has become increasing popular as educators seek methods to avoid sanctions for poor performance. Since tests are not published for widespread public consumption, it is not possible, nor would it be ethical, to align instruction to the actual test questions. Instead educators are seeking ways to align to the content standards because the high-stakes tests are based on these standards. In theory if you are teaching to standards and the test is based on those standards, a curriculum that is aligned to standards and taught with fidelity to those standards will help students meet achievement goals (English).

The Importance of Alignment

Alignment is the great equalizer in this age of accountability (English & Steffy, 2001). One of the primary goals of the No Child Left Behind Act is to provide adequate education to all students, even those who don’t go to the best schools in the nation. Student achievement is continually linked to socio-economic factors. The higher students are on the socio-economic ladder, the more readily they achieve at higher levels (Coleman, 1966; Ravitch, 1995). English and Steffy (2001) attribute this to the fact that students of higher socio-economic status get more exposure to knowledge and skills that are tested. If tests are aligned with curriculum and teachers actually teach that curriculum, then all students would have equal access to tested material regardless of their socio-economic status or the perceived quality of their school.

When a curriculum is aligned to information that will be tested, all students have an equal opportunity to demonstrate achievement. Economically disadvantaged students can do well on tests when they are taught properly, taught the proper information and given feedback about where they stand in relation to the learning goal (English, 2000; English & Steffy, 2001; Stiggins, Arter, Chappuis, & Chappuis, 2007; Waters, Burger, & Burger, 1995). Others argue that despite what might appear on the surface as an equal playing field, there are still cultural mismatches which dismiss the cultural norms of the minority group, promote those of the majority and leave the minority student alienated from the learning experience (Wiggan, 2007). Other researchers point to a link between academic underachievement and the lack of academic language among second-language and bilingual learners. Even if these students are taught the same curriculum intended to make the educational experience equitable, they can fall into an at-risk category when the educational system positions them at cross-purposes with a system that relies on familiarity with the dominate cultural and linguistic background (Vang, 2005).

When curriculum is organized around specific learning objectives and when data is collected and acted upon in relation to those specific learning objectives, or standards, student performance improves (Lauer et al., 2005; Marzano, 2003; Schmoker, 2001; Stiggins et al., 2007; Waters et al., 1995). High standards and assessment related directly to standards results in quality curriculum and instruction. When districts work to systematically focus on student performance data that is tied to explicit outcomes, such as standards, they find that student achievement improves (Waters et al., 1995). A case study conducted in Ohio’s improved schools identified six key effective practices and four principles of implementation. The purpose of the study was to identify the practices responsible for substantial improvement in the school districts. Improved performance was gauged by the Ohio Local Report Card. Using the Delphi technique in conjunction with telephone interviews and site visits, the researchers identified curriculum alignment as the most important key practice (Kercheval & Newbill, 2000). Similar results were found in a study in Virginia schools. During interviews 16 common factors were identified as effective practices for improving student achievement. Seven factors, which included curriculum alignment, were identified as the most important with the other nine being considered as having a positive effect (Virginia Department of Education, 2000).

A study conducted by the RAND corporation examined three state's responses to standards based accountability. Despite each state having varied accountability systems, superintendents in all three states listed three activities as most important in responding to accountability. Along with providing increased support to low-performing students, and engaging in data-based decision making, aligning curriculum ranked as most important (Hamilton et al., 2007). Teachers in those same states had mixed views. They perceived inconsistency with standards and local curricula and they had concerns over accountability in general which led to lower morale. Although they did see beneficial outcomes like increased rigor, they also reported that curriculum became more narrow because it focused on test related content and on students who were close to the proficiency cutoff. Educators are concerned about a single-minded focus on state accountability tests (Hamilton et al., 2007).

Strategies to Achieve Alignment

There is a clear emphasis for teachers to deliver curriculum that is guided by prescribed standards. However, even though educators are aware of standards documents, they lack methods, guidance and appropriate strategies to align these standards with instruction. This dilemma is compounded by the fact that there are too many standards and too many weak standards (Marzano & Kendall, 1997; O'Shea, 2005; Webb, 2007). When a curriculum has been defined and designed to align with state standards or other designated objectives, it is said to be externally aligned. How can teachers communicate with each other and with curriculum specialists to ensure fidelity in the delivery of this curriculum across grade levels or schools within a district? How can they know that the instruction of a particular learning unit is internally aligned so that the knowledge and skills students should know and be able to do actually match state content standards?

Beginning with the end in mind. One method is a framework designed by Wiggins and McTighe (2005) called backwards design. The process is not dissimilar to English's concept of backloading. Backwards design is a three-stage process. Teachers first identify the learning objective. This can be a state content standard or it can be another learning objective designated by the school district or by personal preference. The second stage involves determining what will be the acceptable evidence that learning objectives are met. At this stage teachers develop assessments to evaluate learning. Finally, in the third stage, the teacher plans the learning experiences or instruction to help students reach the stated learning objective. The goal of this design method is that by starting with the objective teachers can help insure that instruction is aligned to the objective. When the objective is a state standard then internal alignment to standards is more feasible.

Daggett (2000) also recommends starting with the end in mind. He says one way to focus instruction on standards and to develop a better understanding of standards is to map the curriculum. Through the process of curriculum mapping teachers can better determine what parts of the curriculum are viable and should be kept along with determining which parts should be dropped. Danielson (2002) shares similar recommendations saying that curriculum experts use a design-down approach that begins with the end in mind when they design curriculum. When development occurs at the school or district level, educators should follow defined steps that clearly link and align local curriculum to content standards.

Curriculum mapping. Jacobs (1997) prescribes calendar-based curriculum mapping to achieve integration and articulation. The calendar-based template incorporates the principles of backwards design. Curriculum mapping is a calendar-based reporting process teachers utilize to record what is taught, when it is taught, how they assess what has been taught, and how what they are teaching relates to content standards. Once teachers have accurately recorded a picture of the operational, or taught curriculum, the curriculum mapping process continues through a series of defined steps that allow teachers to engage in structured dialogue to review, discuss, analyze and make informed curricular decisions based on data. Curriculum mapping is an ongoing and cyclical process intended to keep curriculum up-to-date, to ensure coverage of essential standards-based content for all students and to provide a scheduling mechanism to ensure there is enough time to cover that content.

Curriculum mapping studies. A handful of dissertations have been completed on the topic of curriculum mapping. Over a two-year interval Shanks (2002) compared achievement scores of elementary student before and after mapping. She found that scores improved after mapping but that they were not always statistically significant. In her conclusions she reports that curriculum mapping does have a positive impact on student achievement scaled scores

(Shanks, 2002). It is difficult to conceive how a one year study of one intervention in a school environment could be isolated in a manner that would allow student achievement gains to be contributed to the specific intervention.

Lucas (2005) gathered teachers' perceptions in one suburban school district to determine if they perceive mapping as a tool that increases the efficacy of instructional planning as well as curriculum alignment. He found that they did see it as a useful tool for planning and alignment. Findings indicate they perceive the most value in using mapping for alignment, then for long-term planning and then short-term planning. Furthermore, middle school teachers found it more useful than elementary and high school teachers (Lucas).

Huffman (2002) similarly examined perceptions related to the process of curriculum mapping as a tool for school improvement and as a means to help teachers align state standards to curricular offerings. She utilized survey research in one middle school and her major findings about teacher perceptions in regard to the value of curriculum mapping are: curriculum mapping is valuable tool for school reform; it improves student achievement; it promotes teacher reflection; it allows for the identification of gaps and redundancies; it facilitates curriculum integration opportunities; it does not interfere with more important tasks; there is value in mapping outside of its role in aligning curriculum with standards; it is not viewed as an administrative monitoring tool; it does not diminish autonomy; and it encourages a sense of commonality and educational purpose among staff. Her results in relation to curriculum mapping as a tool for alignment to state standards dealt with teacher perceptions of the usefulness of standards. She reports that the middle school teachers who were surveyed perceive standards as valuable in improving student achievement because they help students meet identified goals and they help teachers engage in sound educational practices (Huffman, 2002).

Most recently Wilansky (2006) examined the attitudes of curriculum in relation to three dimensions of instructional practices. These practices were assessment, standards alignment and professional collaboration. Using survey techniques she investigated teacher attitudes in four public schools and found that teachers overwhelmingly agree that curriculum mapping will improve instruction in their district. Results also indicate they choose to participate in the process. Additionally, curriculum mapping was perceived as a useful tool for identifying gaps and redundancies in the curriculum. Finally, the researcher indicates the most important part of the study was that teachers believe mapping had direct impact on instructional practice in the area of standards alignment, assessment and professional collaboration (Wilansky, 2006).

Considering the collective results of these dissertations there is evidence to support the idea that teachers perceive curriculum mapping as an effective planning tool that improves instructional practice and assists with aligning curriculum to standards. The national director of professional development for Performance Pathways identifies additional variables that may contribute to student achievement. They are distributed educational leadership, faculty collaboration, standards-based curriculum alignment, data analysis, planning and review and classroom assessment (Budan, 2005)

This research study will contribute to this base of knowledge by examining a specific technology tool associated with curriculum mapping, the processes and method of curriculum mapping and the theories that underpin the curriculum mapping process. These three topics will be examined in relation to the theoretical framework and analyzed to determine their role in organization change.

This concludes the curriculum alignment section of the literature review. This section contained information about the concept of alignment, the importance of alignment and current strategies to achieve alignment. The proceeding section of the review includes information about teachers using technologies related to curriculum design and development. One of these technologies is curriculum mapping software.

Teacher Use of Technology in Curriculum Development

The organizational architecture that has existed to support schools in which lecture and books dominate is experiencing pressure to evolve into a system that supports learning with emerging technologies. (Schlechty, 2001). Since the advent of teaching, teachers have been continuously adopting and adapting different types of technology tools. Before computer-based technologies like curriculum mapping software, complex student management systems, interactive whiteboards, powerpoint, blogs, wikis and podcasts, there were slate and chalk, pencils, slide rules, textbooks, mimeographs, filmstrips, overhead projectors, radio and television. Yet despite the plethora of available technologies, adoption and use of instructional technology tools in education continues to lag behind other industries and institutions (Cuban, 1993a; Nickerson & Zodhiates, 1988; U.S. Congress, 1995). Cuban believes this is because of cultural pressures that influence our understanding of what schools should look like, what students should do when they are there and how schools and students in those schools should be organized. Consumers claim they want progress, but in reality they also want the comfort and familiarity of the traditional school structure (Cohen, 1988). Schlechty (2001) echoes this notion saying schools often expel or modify technology so that it does not disrupt the habits of the organization. Papert (1993) concurs saying schools act like the immune system of living organism that is protecting itself from foreign intruder invasion. The school system tries to contain and assimilate the intruder so that it will cause the least disruption to existing conditions.

People form mental models of how things should be and these models create a system for understanding oneself, other people and the environment. These models are formed through both formal training and experience (Norman, 1988). In the case of educational institutions the vast majority of the population spends about 13 years in the K-12 system building a strong mental model of what school looks like. Papert (1993) draws on ideas from Paiget’s concept of adaptation. He uses the terms assimilation and accommodation to explain the introduction of technologies into schools. When we assimilate we make a new concept or tool fit our current mode of thinking, or mental model. An example of this would be a teacher who scans his or her worksheets and put them online. The method of teaching and learning does not fundamentally change in this example, only the tool that delivers the content. When we accommodate, which can be a more difficult process, we modify our mental model, or our internal structure of thinking, to fit the new innovation or circumstance. An example would be a teacher letting students create informational text in a collaborative fashion, online using a wiki. Instead of feeding students a worksheet, the teacher changes the learning situation to allow students to create and construct their own knowledge about a subject and then share this knowledge with the world. In the case of computer technologies, schools have largely dealt with the innovation through assimilation. They have bent the use and purpose of technology to meet existing mental models of how school works (Papert, 1993).

If technology doesn't fit well in schools, why do administrators in schools keep buying it? The push for the adoption of technologies comes from three interrelated forces. First there is pressure for workforce readiness. This means schools need to keep on par with industry so when students exit the public education experience they can be familiar with the advanced technologies they will find in the work place. There are few jobs that don't require some basic computer literacy. A highly skilled workforce is essential for global economic competitiveness in the emerging information-based economy (Cohen, 1988; Cuban, 1993a). A second pressure driving the adoption of technologies is the need for efficiency and productivity. Technology by definition is something that gives us the ability to do more faster and better and this ability is valued in our society. The final force comes from reformers and educational leaders who believe computers and the associated technologies can give relevance, meaning and self-directed learning opportunities to students. Constructivists believe there are better ways to learn information than to absorb large bodies of discrete facts and figures that are unconnected to daily life. (Brand, 1998; Cuban, 1993a).

Technology has the potential to make learning more meaningful and more connected when the student is able to explore and make connections in a self-directed way that makes sense to the individual (Papert, 1993). It also has the potential to change the practice of teachers so that classrooms transition from a teacher-centered focus to one that is learner-centered (Cohen, 1988; Cuban, 1993a; U.S. Congress, 1995). Others argue that historically technology has not fundamentally changed practice but only enhanced processes. For instance, books in the classroom were also supposed to afford more self-directed learning experiences, but instead became integrated into the rigid lecture and seatwork paradigm (Cohen, 1988; Cuban, 1993a). Papert (1998) counters this argument by saying those technologies never really offered anything new, whereas digital computing fundamentally reverses the relationship of learning. These technologies are the learners' technologies which is a radical departure from educational television and radio in the classroom which were still primarily the teachers' technologies (Papert, 1998). What technologies can be considered the teachers' technologies and what are the potential for these technologies to fundamental change the structure of curriculum development and management?

Recent technologies associated with computers and the internet have dramatically increased the frequency and variety of technologies available to educational institutions (Cuban, 1993a). The plethora of Web 2.0 technologies like blogs, wikis and podcasts are growing in number everyday and hold potential for educational use (Richardson, 2006). These technologies have the potential to help shift the focus from the technology itself to changes in learning and teaching that are possible because of the technology (Pierce, 2007). Some of these technologies persist and are integrated into the existing curricula and many do not because schools are very change prone, but not change adept (Brand, 1998; Nickerson & Zodhiates, 1988; Schlechty, 2001).To make use of these technologies a new type of teacher workforce is needed in the United States; one that will embrace the technology, one that is comfortable and agreeable with the expectation to use technology in a meaningful way; in essence one that can bridge the gap between teaching and technology (Pierce).

In order for educators to accommodate a new technology they need a clear understand of the potential of the technology. What will it help them do better? They also need ample time to be trained in a manner that allows them to acquire skills, to experiment in order to gain confidence and to apply and transfer the technology into their practice classrooms (Brand, 1998; U.S. Congress, 1995). Ideally the training should occur outside of the regular school day and it should be ongoing, not just a one-time experience. Additionally the training should be differentiated so that it is geared for different levels of technology readiness. It is not efficient for novice user and those adept with technology to have the same learning experience (Shelton & Jones, 1996). Teachers arrive at a technology learning experience with a wide range of learning abilities and often with a certain level of personal anxiety (Brand, 1998).

Technology and staff development. When considering appropriate designs for technology staff development it is important to consider the social organization of schools which includes the human element (Ray, 1991). It is the needs of the teachers and not the cabling or hardware that must take precedence when planning effective technology staff development (Bailey & Pownell, 1998). Using a parallel scheme to Maslow's (1999) hierarchy of needs, five levels of technology staff-development are defined (Bailey & Pownell, 1998).

Level 1 includes physiological needs. Unless these basic needs are met, humans are not motivated to satisfy high level needs. In regard to technology use, teachers must have basic technology needs satisfied before they can reach higher levels of technology integration. Basic needs in terms of technology are: time to learn the new tools; a technology plan that outlines the larger role of technology in a district; a staff development plan that is created with participant input, provides resources, continuity, flexibility, clear expectations and sound evaluative procedures; the necessary software, hardware and accessibility; an infrastructure that supports the new learning; and a technical support system that allows teachers to get help with problems. Level 2 needs deal with safety and security. They are respecting privacy and confidentiality, dealing with fears and frustrations about technology (technophobia), ensuring the implementation of technology has real long-term administrative support, confidence in the technology infrastructure, and rules and regulations that provide policy support. Level three deals with belonging needs. In the hierarchy of needs scheme this means people feel accepted and part of a group; they know where they fit. From a technology standpoint this means engendering a sense of belonging and ownership that creates confidence and a culture for skill building. Level three needs include opportunities for peer interaction. These interactions might include participation in technology committees or teaming with others to plan significant technology projects. These interactions might also mean participating in activities that build belonging in the larger community to create the support for technology. Level four needs relate to esteem. In technology-speak these translate to peer recognition, team leadership, teaching competence, technology innovation and extrinsic rewards. Finally, level five self-actualization needs related to technology are teacher empowerment, continual innovation, continuous exploration and creative applications of technology (Bailey & Pownell, 1998).

Technology increases communication. One significant change that computerized technology offers to teachers is the ability to increase communication with each other, with experts in the field, with students, with parents and others outside the normal parameters of the school institution (U.S. Congress, 1995). With this increased ability for communication comes a need for knowledge management. When information is shared among or between people, each party gains in their understanding and creates knowledge based on their interaction and experience with the new information (Petrides & Nodine, 2003). Davenport and Prusak (2000) say that with use, knowledge assets increase and contribute to the proliferation of new ideas. This creates a situation of shared knowledge that not only benefits the receiver, but is also beneficial to the giver.

When communities can share knowledge they can build the groundwork for shared vision which is a key component of change (Kotter, 1996).

Technology Tools For Alignment

Despite the fact that standards documents provide detailed information about the knowledge and skills that should be taught, they provide little guidance as to how teachers and school should go about this task. Educators are challenged with translating standards into instructional practice (Daggett, 2000). As a result, schools across the nation are facing the dilemma of trying to implement standards designated by external entities like departments of educations (Marzano, 1999). Curriculum mapping with curriculum mapping software is one approach being utilized by school districts.

Although the technique of curriculum mapping has been around since the early 1980’s when it was introduced by English (1980). The recent development of web-based curriculum mapping software and the popularity of Jacob’s book *Mapping the Big Picture* (1997) has resulted in wider implementation of this process in K-12 schools. The software makes the process efficient because elements of the curriculum are entered into a relational database. The elements include essential questions, content, skills, assessment, lesson and content standards. The database allows for anytime, anywhere, real-time access to curriculum data across a school district. The technology makes it possible to house and manage the massive data of a K-12 curriculum. Additionally the software makes the curriculum database searchable to all users of the software. If I’m a new teacher I can search to find maps of experienced teachers to inform my own curriculum development. Two major providers of curriculum mapping software, TechPaths and Curriculum Mapper claim product use in nearly every state in the union and in international schools (Collaborative Learning Inc., 2007; Performance Pathways, 2007). These software companies claim that curriculum mapping improves student achievement, but currently there is not sufficient empirical evidence to support this claim. Currently there are no known studies that examine the curriculum mapping process in conjunction with the use of curriculum mapping software, TechPaths or otherwise. As previously stated, software is a new development that has increased the prevalence of curriculum mapping activities. It is imperative to study this phenomenon to determine its benefits or drawbacks.

This concludes the section of literature review dealing with technology tools for curriculum development and design. The purpose of this chapter was to survey relevant literature that builds understanding about the current emphasis on alignment of curriculum to content standards. It also included information about some of the current tools, methods and theories that are being promoted to increase alignment. The next chapter will focus on the methodology of the proposed study.

CHAPTER 3

This purpose of Chapter 3 is to describe the research methodology used in this study. The chapter begins with a discussion about the context for the study. This is followed with information about the participants in the study, the procedure and a description of the instrument. Finally, details about the research design and data analysis are provided.

A Context for the Study

This study utilizes a public data set that was collected by a northwestern state Department of Education (DOE) in the spring of 2006 for the purpose of assessing the status of a statewide professional development initiative intended to promote processes that increase student achievement. The initiative was part of a federal funded Teacher Quality Enhancement (TQE) grant entitled the Every Teacher Grant. Federal grant programs have reporting requirements and this state data collection helped to fulfill that requirement. In addition to the summative data that was collected and reported to federal authorities, the data can potentially be utilized to provide formative data to school-level and state-level personnel who are invested in the professional development initiative. Formative data can be used as a benchmark to gauge the current status of the initiative and then adjustments can be made to alter and improve the initiative to increase the likelihood of success.

ESA involvement. At the time the data was collected this researcher was employed as an Educational Service Agent (ESAgent) in one of the seven Educational Service Agencies (ESA) that serve different sectors of the state.

ESAs in the northwestern state perform contract services for the DOE, but are not employed by DOE. One of the contractual services is to provide professional development related to the curriculum mapping initiative; however ESAgents played no role in the design of the survey or the organization and design of delivery of the survey. Over the course of a one month collection period, personnel in ESAs were tasked with prompting teachers in schools to fill out a scannable survey or to complete the online version. The ESAgents perform this task as part of their contractual services to distribute information from the DOE to school personnel. The means by which this prompting occurred was via emails to administrative personal or during face-to-face interactions with school staff. There was no specific protocol or script involved in this prompting. DOE officials simply encouraged ESAgents to assist in reminding school personnel to complete the surveys during the designated collection window. This researcher's involvement in the distribution of the survey as an ESAgent consisted of emails to administrators in three school districts. The email asked the administrator to encourage participants in the school to complete the survey. In the case of scannable paper surveys, the ESAgents distributed and collected the physical copies of the survey and sent them to the DOE. This researcher did not distribute or collect the paper survey forms. Electronic survey forms were automatically submitted to the DOE. ESAgents did not review, process or analyze the data.

The data set. The data set is public information and to date the descriptive information from the data set has been utilized by state officials to determine if they should continue to financially support the purchase of the curriculum mapping software. In the first two years of the initiative the state fully funded the yearly fee for use of the software. In subsequent years the state has subsidized the cost by providing two-thirds of the costs and individual school districts incur one-third of the cost. The Director of Curriculum and Instruction in the Department of Education in this northwestern state has granted this researcher access to the data set for the purposes of this study. The researcher reanalyzed the data in two ways. A subset of the data was utilized to obtain descriptive statistics that inform the two research questions related to tool and method. The entire data set was utilized in a factor analysis to inform the third research question related to theory.

Data Collection Procedure and Instrument

The survey was administered in the spring of 2006 by the DOE to teachers in the northwestern state. Responses were collected from 2218 participants in the state's school districts with the assistance of ESA personnel. All staff in school districts across the state had the opportunity to complete the survey; however common sense dictates that it was only applicable to districts and relevant personnel that were engaged in curriculum mapping.

Distribution of the survey. Data for this study were gathered from the questionnaire *A Northwestern State Department of Education Curriculum Mapping Survey Spring 2006.* See Appendices B and C for the full questionnaire. The questionnaire was delivered to participants either electronically or via a scannable paper/pencil booklet with the assistance of ESA personnel. The survey was an intact instrument developed by Dr. Susan Udelhofen and reviewed by Dr. Bena Kallick and Dr. Tammy Bauck. The survey was constructed with a Likert-like response option consisting of 1=Strongly Agree, 2=Agree, 3=Disagree, 4=Strongly Disagree, NA=Not Applicable and DK=Don't Know.

Questionnaire

The questionnaire consisted of three parts and five sections that contained a total of 87 items. The three parts of the survey were entitled: Background Information, Curriculum Mapping Process and Comments. The second part of the survey, Curriculum Mapping Process, was divided into five sections that are described after they are listed. On the survey instrument the five sections were called: *I. Preliminary Preparation, II. Curriculum Mapping Implementation, III. Curriculum Mapping Leadership, IV. Curriculum Mapping Next Steps and V. Curriculum Mapping Software*. The *Preliminary Preparation* section was designed to determine if the staff and administration were informed about the initiative, if they were supportive and if any long-range planning had been conducted to support the implementation. The *Curriculum Mapping Implementation s*ection gathered information about the basic mapping process, the review process, planning, the role of other teachers and time and resource concerns. The *Curriculum Mapping Leadership* section gathered information about the level of administrative involvement and the composition, training and status of a leadership team. The *Curriculum Mapping Next Steps* section was designed to ascertain the value and use of mapping data as well as specific information about the use of essential questions and core/consensus maps. This section also asked respondents about their perceptions of the future of mapping.

The fifth and final section, *Curriculum Mapping Software*, dealt specifically with participants' use of mapping software. It contained a section for anyone that was using software and a separate one for participants who utilized TechPaths software.

Participants

The participants were teachers in school districts in a northwestern state that were engaged in curriculum mapping processes using TechPaths, a curriculum mapping software tool produced by Performance Pathways Inc. Participants utilized the software tool during the 2004-2005 and 2005-2006 school year. The Department of Education in this state provided grants to 96 schools for the purpose of engaging in curriculum mapping. The funds were provided through a federal Teacher Quality Enhancement grant entitled the Every Teacher Grant. Funding for 53 schools in the 2004-2005 school year totaled $453,000. Funding for 43 schools participating in 2005-2006 totaled $666,247 (Stadick-Smith, 2005). Each district was provided with $1000 for materials as well as monies for travel to regional training events. Teachers were paid $100 per day stipends and given $7 a day for meal provisions for up to three days of training. Additionally district leadership team personnel were provided with $100 stipends (Stadick-Smith). Nearly half the participants would have been involved in mapping for two years while the other half participated for a period of one year prior to administration of the survey.

The opportunity to use the software was voluntarily for participants per school district and was offered by officials at the Department of Education as part of a tool box approach to promote student achievement (Pogany, 2005). Primarily the decision to use the software was made by an administrator or curriculum mapping leadership team. If a district or school within that district opted to utilize the product and process, individual classroom teachers at that location were required to be involved. In the state sponsored survey administered to all schools involved in curriculum mapping only 18% of the respondents indicate they were involved in the decision to implement mapping in their building.

Participant demographics. Participants in each district were contacted through an Educational Service Agency (ESA) representative via email or face-to-face during teacher in-service events to distribute the survey in electronic form or scannable booklet. Although 2218 participants completed the survey, only teacher participants using TechPaths are included in this study. After eliminating other respondents such as administrators, ESA personnel, state personnel and non-TechPaths users, a total of 1152 survey responses were considered for this study. Of the 1552 respondents, 1174 were female, 353 were male and 17 did not respond to this item. The greatest numbers of respondents are in the 50+ age category at 519, 381 are age 40-49, 396 are 30-39 and 243 are 20-29. Of the respondents six have doctorate-level degrees, 339 have masters-level degrees and 1195 have a bachelor-level degree. Of the 1552 respondents, 120 report having no experience or background in curriculum mapping, 488 report very little experience, 777 have some experience and 156 have quite a bit of experience, zero respondents report being an expert. These demographics provide background information about the respondents that may be important in the interpretation of the results. See Appendix B for detailed information related to the demographic data that was collected.

Participant responses. Participants had a month long window to voluntarily respond. A total of 2,218 responses were collected from 119 school districts. In addition to the 96 districts that received grants, there were other districts that voluntarily participated without the grant incentive. Those participants reporting use of TechPaths software as part of the curriculum mapping initiative numbered 1720 from 96 districts. Some districts chose to use other software or no software at all. For the purposes of this study respondents that were not using TechPaths were excluded. Additionally respondents included district-level administrative personnel, ESA personnel and state-level personnel. These responses were also excluded from the data analysis for this study. After exclusions the final number of participants available for analysis in this study totaled 1552 from 96 districts.

A Descriptive Quantitative Study

This quantitative study is descriptive in nature and employs survey research methodology to obtain cross-sectional data collected at one point in time. Survey methods are intended to provide quantitative data that provides a numerical description of attitudes, opinions or trends in a population by studying a subset of that population (Creswell, 2003). The DOE has collected a large data set related to the curriculum mapping initiative but has not analyzed this data in a way that informs the research questions of this study. It is beneficial to perform further analysis utilizing the existing data set to contribute more information to the body of research related to technology tools for curriculum alignment. Survey methods allowed for widespread distribution in an efficient and affordable manner. The survey research conducted in this study was not random, but rather it was purposeful in that only specific schools utilizing the software were selected for inclusion. The research is exploratory in nature and therefore no specific conclusions will be drawn to subsets of the population.

Data Analysis

The existing data was pared down to eliminate any schools districts that were not using TechPaths software. It was further processed to eliminate administrators and other non-classroom teachers who completed the survey because the research questions only focus on teacher use and perceptions. The data analysis was conducted in two phases.

Phase 1 Descriptive Analysis. The first phase was conducted using the following steps. First, each item from the existing survey was coded to determine if the item provided information about the research question related to use of the curriculum mapping tool, the research question related to the method of curriculum mapping or neither of these research questions. This coding process is necessary because the existing survey was not created specifically for this study and it exceeds the scope necessary to answer the research questions related to tool and method, so a subset of the survey items was used. Once items are aligned with the appropriate research question the data from each item was imported into statistical software to generate descriptive statistical information. This descriptive information included demographic information as well as information specific to each item identified in the coding process. A spreadsheet program, Microsoft Excel, was used to calculate the percentage of each Likert-like response for each question.

Phase 2. The second phase of the analysis is designed to inform the third research question related to theory and consists of an exploratory factor analysis. Results from all 87 items on the survey were considered in this process in order to identify underlying constructs that may identify a pattern or theory related to the use and understanding of curriculum mapping by teachers. After initial observations about the nature of the 87 questions, the set of questions used for the factor analysis was reduced to 53 questions. The questions that were eliminated were designed for non-teachers and non-users of TechPaths curriculum mapping software.

Factor analysis is an inferential statistical technique used to reduce a set of variables to subsets, or factors, where the subsets are relatively independent of other subsets. Factor analysis is appropriate to use when dealing with large quantities of data. An advantage of using factor analysis is that it can be used for both subjective and objective attributes and it is relatively easy and inexpensive to perform with appropriate software. It can be used to identify patterns or constructs that may not be apparent in direct analysis of the data. A disadvantage of using factor analysis is that it still relies on human judgment to name and identify the attributes once they are grouped by the software (Tabachnick & Fidell, 2007).

Before the factor analysis can be performed the raw data that has been aggregated in a spreadsheet program must be manipulated to work well with the statistical software program. The Likert scale responses were recoded so that each one exists as a numerical value. For instance, the response NA=Not Applicable was replaced with the numerical value 8888. Once the data was recoded it was imported from the spreadsheet program into the statistical software program Software Package for the Social Sciences (SPSS). The first step was to perform a bivariate analysis in order to generate a correlation matrix. The bivariate analysis compares each item of the survey to every other item on the survey for the purpose of describing a numerical association between them. In this factor analysis there are 56 items so the correlation matrix generated from the bivariate analysis consists of a matrix that contain 56 items on the y-axis and 56 items on the x-axis for a total of 3136 numeric associations. Each item was compared to itself as well as the other 56 items. It is not practical to view this amount of information to draw conclusions or infer meaning from the data.

In order to obtain more meaningful information from this massive data set, the next step was to extract principal components from the matrix. This step is called principal component analysis and essentially it identifies the components with the most meaningful numeric associations. This process generates a list of factors and ranks them in order of most significant to least significant. There are several numeric values associated with this ranking. One value is a numerical descriptor called an eigenvalue. An eigenvalue represents the variances of the factors and generally only factors with an eigenvalue greater than 1.0 are considered to be significant enough to be included as a factor (Tabachnick & Fidell, 2007).

Once the significant factors were identified it was up to the researcher to review the items associated with a factor, consider the conceptual framework that guides and, the literature that informs the study and then name this factor. For instance, there is a section on the survey that deals with leadership of the curriculum mapping initiative. It was probable that several of the items in that section would group together to form a factor and one might choose to call this factor *leadership*.

The survey utilized in this analysis contained 56 items and the number of participants exceeded 1500. From a numerical standpoint it was highly likely that eight to ten factors would be identified at the conclusion of the factor analysis.

Chapter 3 presented the methodology for the study used to respond to the three research questions. Chapter 4 presents results of the study.

CHAPTER 4

Introduction

This purpose of this study was to understand more about the tools, methods and theory that may underlie teachers' use of a technology-based tool that provides a method to align K-12 curriculum with state standards. The three research questions were generated from a conceptual framework based on Senge's (1994) work in organizational change and the literature related to curriculum, content standards, alignment and technology tools (Cuban, 1993a; Danielson, 2002; Jacobs, 2004; Marzano, 2003; Ravitch, 1995) . The study focused on discrete elements of the conceptual framework related to tools, methods and theories. The research questions correlated specifically with these elements. The study attempted to expand the research by providing descriptive information about the tools, methods and theories of the use of a technology tool to promote a curriculum mapping initiative. The intention was to relate this information back to the larger theoretical framework in order to better understand the implications of the implementation of technology-based tools and processes in schools.

The purpose of this chapter is to report the results of analysis of the research questions. The first section presents some basic demographic information about the respondents and the results of the analysis related to research question one. The second section gives results of the analysis related to research question two. The results in sections one and two are presented in relation to emergent themes that formed as a result of the relationships of the survey questions themes. These themes have a strong relationship to the factors generated in the factor analysis and will be discussed further in Chapter 5. The third section offers results of the factor analysis which corresponds to research question three. The three research questions relate to tool, method and theory, respectively.

As previously stated, this study utilized existing survey data that provided information that was beyond the scope of the study. Therefore subsets of the data were organized for analyses. Each survey questions was considered and placed in a subset that corresponded to the use of the curriculum mapping tool, the method of curriculum mapping or neither of these categories.

Once the subsets relating to tool and method were created, the spreadsheet program Microsoft Excel was utilized to generate percentages of each Likert-like response for each survey question. The Statistical Package for the Social Sciences (SPSS) was used to generate data related to mean and standard deviation for each questions and to perform a factor analysis.

Research Question One: Curriculum Mapping Tool Subset Results

The results of the analyses presented in this section serve to inform the first research question related to the curriculum mapping tool. The research question is: To what extent are teachers able to use the TechPaths curriculum mapping software in order to create instructional units of study that are internally aligned with prescribed content standards in a northwestern state?

Before presentation of the results of research question one, some basic demographic information about the respondents are presented. Of the 1552 respondents, 1174 were female, 353 were male and 17 did not respond to this item. The greatest numbers of respondents are in the 50+ age category at 519, 381 are age 40-49, 396 are 30-39 and 243 are 20-29. Of the respondents six have doctorate-level degrees, 339 have masters-level degrees and 1195 have a bachelor-level degree. Of the 1552 respondents, 120 report having no experience or background in curriculum mapping, 488 report very little experience, 777 have some experience and 156 have quite a bit of experience, zero respondents report being an expert. These demographics provide background information about the respondents that may be important in the interpretation of the analyses. For instance, the level of experience the respondents report related to curriculum may be important in understanding the results. See Table 1 for a compilation of these demographics.

Table 1.

Participant Demographics

Number of Participants							
Age		Gender		Education		Mapping Experience	
20-29	243	Male	353	Bachelor	1195	None	120
30-39	396	Female	1174	Masters	339	Very little	488
40-49	381			Doctorate	6	Some	777
50+	519					Quite a bit	156
						Expert	0

(*N* = 1552)

The results of the analysis related to the first research question were generated from survey questions collected from the survey *A Northwestern State Department of Education Curriculum Mapping Survey Spring 2006*. See

Appendix D for a listing of these survey questions. Participants responded to each survey question using a Likert-like scale consisting of 1=Strongly Agree, 2=Agree, 3=Disagree, 4=Strongly Disagree, NA=Not Applicable and DK=Don't Know. The spreadsheet program Excel was utilized to generate percentages to each point on the Likert-like scale for each survey question. These percentages are reported in Table 2. Means and standard deviations for each survey question were also generated using SPSS.

Table 2.

Curriculum Mapping Tool Subset Results

Survey Questions	Strongly Agree/ Agree	Disagree/ Strongly Disagree	Not Applicable	Don't Know	Mean (standard deviation)
software facilitates mapping process	93%	4%	0%	4%	1.79 (.514)
reports feature of the software assists with review process	36%	46%	11%	7%	2.66 (.775)
software tool helps colleagues communicate and collaborate effectively about maps	50%	32%	8%	9%	2.45 (.773)
maps are aligned to the state academic standards	83%	7%	5%	4%	1.88 (.571)
adequate training to use the software to enter mapping data	64%	29%	3%	1%	2.30 (.687)
confident using the software program	59%	32%	3%	1%	2.33 (.697)
use of the search function of the software	49%	37%	3%	5%	2.44 (.719)
used the search function to analyze data	37%	49%	5%	4%	2.62 (.728)
use of the TechPaths report functions	45%	41%	4%	5%	2.51 (.728)
used the reports function to analyze data	37%	49%	5%	4%	2.63 (.737)
maps and reports allow for efficient comparison and analysis of data	49%	18%	4%	25%	2.25 (.692)
participated in an on-site training session	73%	15%	4%	3%	2.11 (.630)

(*table continues*)

Survey Questions	Strongly Agree/ Agree	Disagree/ Strongly Disagree	Not Applicable	Don't Know	Mean (standard deviation)
software helps effectively develop and use curriculum maps	58%	26%	6%	6%	2.32 (.733)

Note. Only key words from each survey question are provided.
(*N*=1152)

Curriculum mapping tool results. The results related to the curriculum mapping tool are reported in three themes. These themes are related to the content of the survey questions and are summarized at the end of this reporting. The first theme relates to software availability and training. Respondents strongly agreed and agreed to a level of 93% that a curriculum mapping software program was in place to facilitate the process and 73% strongly agreed and agreed that they participated in an on-site TechPaths training sessions. Only 64% strongly agreed and agreed that they were adequately trained to use the software. A related question reports confidence in use of the software at 59% for strongly agree and agree.

These results indicate that the software was available to the vast majority of the group. Interestingly all the participants in this survey were expected to have had access to software because only districts using the software were included in this study. This may be related to the demographic information associated with the level of experience and background where approximately one-third reported very little or no experience with curriculum mapping.

The second theme dealt with the ability to use the functions of the software including reporting and searching. It was reported in the strongly agree and agree category that less than half, 49% know how to use the search function and even fewer, 37%, reported that they strongly agree and agree they have used the function to analyze mapping data. A similar pattern exists in the use of reports, with 45% reporting that they strongly agree and agree they know how to use the reports and only 37% reporting that they strongly agree and agree they have used them to analyze mapping data. The respondents reported at a rate of 36% that they strongly agree and agree that they have utilized reports as part of the curriculum mapping review process.

These results are not unexpected given that participants in school districts associated with the study have only been using the curriculum mapping software and process for one or two year periods. Another indicator to support this assumption would be that when asked if the reports generated from the software allowed for more efficient comparison and analysis, 25% reported that they don't know. It appears that one-fourth of them don't know because they either don't know how to run the report, they just haven't gotten to that point in the process or they don't know how to compare data.

The third theme of the survey questions related to this research question dealt with using the software for a specific purpose. In terms of the software assisting with communication and collaboration, 50% reported they strongly agreed or agreed the software more effectively assisted this process. Respondents reported that reports generated in TechPaths allowed for more efficient comparison and analysis of mapping data to a level of 49% in the strongly agree and agree category. Respondents reported that TechPaths helped them more effectively develop and use curriculum maps to a level of 58% in the strongly agree and agree category. When asked if their curriculum maps were aligned to state content standards, 83% strongly agreed or agreed with this statement. Approximately half of the respondents reported use of the software for communication, collaboration and data analysis.

In summary these descriptive results suggest the extent to which teachers are able to use the TechPaths curriculum mapping software in order to create instructional units of study that are internally aligned with prescribed content standards in a northwestern state. The teachers have the software and they appear to have been trained. Nearly half appear not to be skilled in use of some features of the software or they appear not to have progressed to a point in the process where they have needed to learn to use these features. Despite this level of skill use, more than half appear to be effectively developing maps and more than four-fifths of them appear to have aligned the maps to content standards.

Research Question Two: Curriculum Mapping Method Subset Results

The results presented in this section inform the second research question related to the method of curriculum mapping. The second research question is: To what extent do teachers using TechPaths report increased understanding about how instruction aligned to standards improves practice and influences student achievement?

The analyses related to the method of curriculum mapping were conducted using a subset of survey questions from *A Northwestern State Department of Education Curriculum Mapping Survey Spring 2006*. See

Appendix E for a listing of these survey questions. Participants responded to each survey question using a Likert-like scale consisting of 1=Strongly Agree, 2=Agree, 3=Disagree, 4=Strongly Disagree, NA=Not Applicable and DK=Don't Know. The spreadsheet program Excel was utilized to generate percentages of responses to each point on the Likert-like scale for each survey question. Percentages are reported in Table 3. Means and standard deviations for each survey question were also generated using SPSS.

Table 3.

Curriculum Mapping Method Subset Results

Survey Question	Strongly Agree/ Agree	Disagree/ Strongly Disagree	Not Applicable	Don't Know	Mean (standard deviation)
attended introductory meeting that described the mapping process before attending training	58%	35%	1%	1%	2.40 (.841)
curriculum mapping process was effectively introduced before I started	66%	32%	2%	1%	2.32 (.739)
clear understanding of the process before creating maps	48%	48%	2%	1%	2.55 (.759)
curriculum mapping can improve education in a northwestern state	63%	25%	1%	12%	2.24 (.774)
mapping benefits the teaching practice	62%	26%	1%	12%	2.28 (.768)
established timeline for mapping before starting initiative	52%	33%	2%	13%	2.42 (.773)
initiative clearly identified in district's school improvement plan	34%	16%	3%	46%	2.31 (.731)
district policies/procedures reviewed to ensure support of work/processes	31%	14%	2%	53%	2.36 (.706)
Independently completed an individual curriculum map	52%	32%	15%	0%	2.20 (.463)
independently completed a map for every class	37%	53%	9%	0%	2.62 (.822)

(*table continues*)

Survey Question	Strongly Agree/ Agree	Disagree/ Strongly Disagree	Not Applicable	Don't Know	Mean (standard deviation)
adequate time to complete individual maps	44%	49%	5%	1%	2.68 (.896)
reviewed groups of colleagues' maps at grade level	56%	29%	14%	0%	2.32 (.804)
reviewed groups of colleagues' maps beyond grade level	53%	37%	9%	1%	2.42 (.807)
reviewed groups of maps outside my building	34%	52%	13%	1%	2.70 (.805)
adequate preparation/guidance to review other teachers' maps	43%	46%	9%	1%	2.60 (.776)
small groups met to discuss/review maps	58%	33%	8%	0%	2.40 (.773)
adequate time for small groups to discuss/review maps	44%	45%	9%	1%	2.60 (.797)
guidelines for map review with colleagues	49%	37%	11%	2%	2.48 (.772)
all steps of the initial cycle implemented as proposed	41%	35%	9%	14%	2.53 (.769)
analyzing data provides basis for curricular and professional development decisions	64%	16%	1%	17%	2.18 (.657)
mapping has long term positive effects on instructional design/delivery	53%	20%	1%	25%	2.27 (.747)
maps are aligned to the state academic standards.	83%	7%	5%	4%	1.88 (.571)
good understanding long term benefits of mapping	54%	35%	2%	8%	2.43 (.781)

Note. Only key words from each survey question are provided.
(N=1552)

Curriculum mapping method results. The results of the analysis related to the curriculum mapping method are reported using five themes related to the content of the 23 questions and summarized at the end of this reporting. The first theme relates to preliminary preparation. Teachers strongly agreed or agreed that they attended an introductory meeting at a rate of 58%. They strongly agreed or agreed at a rate of 68% that the curriculum mapping process was effectively introduced before they got started. In a related question they reported having a clear understanding of the mapping process before creating a curriculum map at a rate of 48% in the strongly agree and agree category.

The second theme deals with district level communication and planning about the method. Respondents reported that a specific timeline for mapping was communicated before mapping began at a rate of 44% in the strongly agree and agree category. It appears that respondents are unsure how mapping relates to the district’s school improvement plan with 46% reporting that they don’t know. When asked if district policies had been reviewed to ensure they support the curriculum mapping process 53% did not know.

The third theme deals with teachers perceptions of the benefits of the method of curriculum mapping. In the strongly agree and agree category, 63% believe curriculum mapping can improve education in the state and 62% strongly agreed or agreed that curriculum mapping benefits the teaching practice of teachers in their building.

The fourth theme is related to individual reporting of completion of the steps of the method. In the strongly agree and agree category 52% of respondents reported that they completed an individual map with content, skills and assessments. A reduced number, 37%, reported in the strongly agree and agree category that they completed a map for every class they teach. This would be logical because teachers might start out mapping one subject at a time. There were survey items that specifically dealt with the process of reviewing colleagues maps. Respondents reported that they strongly agreed or agreed that they met with small groups of colleagues, that they reviewed maps in the building or they reviewed maps at their grade level at a rate of 58%, 56% and 53%, respectively. When asked if they had guidelines to follow during these reviews, 49% strongly agreed or agreed with this statement. Only 34% agreed or strongly agreed that they reviewed maps outside of their building. This would be consistent with the fact that nearly half do not know how to use the search feature as reported previously. In terms of available time to complete these processes, 44% strongly agreed or agreed that they had adequate time to complete maps. Similarly 44% strongly agreed or agreed they had time to meet with colleagues to share maps. A concluding question within this theme asked if all steps of the cycle had been implemented as proposed; 41% strongly agreed or agreed with this statement and 14% didn’t know.

The fifth and final theme deals with big picture perceptions of how this method informs practice. When asked if curriculum mapping data analysis provides a basis for making curricular and professional development decisions, 64% strongly agreed or agreed. In terms of individual perceptions about the understanding of the long term benefits of mapping, 54% strongly agree or agree they have a good understanding, where as 53% report they strongly agree or agree that curriculum mapping has long term positive effects on instructional design and delivery. Interestingly 25% report that they don’t know if curriculum mapping has long term positive effects. One of the items reviewed for research question one is also included in this analysis of research question two. Teachers report their maps are aligned to state content standards at a rate of 82% in the strongly agree or agree category. This item fits both questions because it indicates that software was used to accomplish this and mapping the curriculum to content standards is integral to the method of curriculum mapping.

In conclusion, the previous section reported the extent to which teachers using TechPaths report increased understanding about how instruction aligned to standards improves practice and influences student achievement.

Curriculum Mapping Theory Results

A factor analysis was performed to generate results related to the third research question. The third research question is: What are the factors that represent the underlying constructs of curriculum mapping and how do they correspond to the elements of organizational change presented in the conceptual framework?

All survey questions from *A Northwestern State Department of Education Curriculum Mapping Survey Spring 2006* were considered for the factor analysis. Factor analysis is an inferential statistical technique used to reduce a set of variables to subsets, or factors, where the subsets are relatively independent of other subsets.

Reducing the data. During the initial analysis of data, all survey questions were reviewed and some of the questions were organized into subsets. It was observed that some of the survey questions were not highly applicable to teachers. They were designed to gather information from other school district personnel such as an administrator, a building leadership team member, a curriculum director or ESA personnel. It has been previously stated that the survey exceeds the scope of this study. This observation was confirmed by quantitative results of missing data. Missing data was defined as data that was actually missing because the respondent chose not to answer a question, or answered Don’t Know or Not Applicable. Using the raw data in an Excel spreadsheet, the researcher calculated the number of responses in these three categories. A group of questions with the highest numbers of DK = Don’t Know responses had similar characteristics; in general they were designed to be answered by an administrator, a building leadership team member, a curriculum director or ESA personnel.

An example of a survey question included in this category is: *The leadership team has a clear picture of the curriculum mapping initiative*. A respondent would need to be on the leadership team to answer this question and there is no way to identify which respondents were members of a leadership team. This group of 25 questions was eliminated from the factor analysis and these questions are considered as a factor related to knowledge about the infrastructure of the organization and are reported in the findings.

Additionally in section five of the survey, one set of questions was directed at participants who were using curriculum mapping software other than TechPaths. These nine questions were eliminated because they were not applicable to this study. This study specifically relates to use of TechPaths curriculum mapping software. In total 34 of 87 questions were eliminated which left a total of 53 questions available for the factor analysis.

The factor analysis. After the strategic elimination of survey questions that may be unrelated to the development of theory about curriculum mapping, the analysis proceeded. SPSS was utilized to generate a set of descriptive statistics that consisted of the mean, standard deviation and the number of cases used in the factor analysis. These statistics were generated using a listwise deletion of missing cases in the data file. In the initial report only 170 surveys had complete results. The statistics were re-run using a pairwise configuration; this resulted in greater numbers of cases for each question. The numbers are variable for each item. Because both configurations delivered consistent and comparable results that generated 10 factors, the study proceeded using the pairwise configuration because it is more desirable to include data from more respondents in the analysis. Data from a greater number of respondents generates more meaningful results.

SPSS software was used to generate two tests that provide a measurement of the quality of the data that should be met before it is used in a factor analysis. The Kaiser-Meyer-Olkin measure of sample adequacy provides a measurement between 0 and 1, with values closer to 1 being more desirable. This number gives an indication about the ability of the data to be grouped in smaller sets. A minimum suggested value is .6. The result in this study was .901. The second test was Bartlett’s Test of Sphericity that tests the strength or the relationship of the variables. This test is measured using a null hypothesis. In the case of this study the significance was .000 so the null hypothesis could be rejected and the factor analysis could proceed with confidence.

Next communalities were generated for each survey item. This number represents the proportion of each item's variance that can be explained by a factor. This is accomplished by performing a bivariate analysis in order to generate a correlation matrix. The bivariate analysis compares each item of the survey to every other item on the survey for the purpose of describing a numerical association between them. The communalities are calculated to explain the total variance. The total variance is defined as the eigenvalue. This process generates a list of factors and ranks them in order of most significant to least significant. The factors are listed in a matrix with the highest variance, or eigenvalue, listed first and diminishing values follow. Factors are listed for each of the items in the factor analysis, but only items with an eigenvalue of 1 or more are considered significant. In this study there were 10 factors with an eigenvalue greater than 1. The analysis generated 10 factors, the names of which are listed in Table 4. These 10 factors account for 66% of the difference in the way people responded to the survey.

Table 4.

10 Factors and Associated Eigenvalues

Factor	Eigenvalue
development of practice in a community	16.284
teacher perceptions related to benefits and value of the innovation	3.187
building capacity to utilize the tools of the innovation	2.880
school leadership for implementation of innovation	2.477
teacher capacity related to advanced use of the tools of the innovation	1.887
building a context for understanding the method of the innovation	1.428
teacher perceptions of status in relationship to the implementation continuum	1.263
application of the innovation for alignment of standards and data analysis	1.221
supporting the innovation with distributed leadership	1.145
teacher perceptions regarding adequacy of time for integration of the innovation	1.038

These factors were created by a grouping of survey questions that most highly correlate with each other. These items are identified in relation to each factor in a principal component matrix and a value is assigned to each question to indicate its level of influence. This is called the factor loading. There are several strategies and techniques within the software program SPSS that can be manipulated to generate the most logical loading of these factors. In this case a rotation method called a Promax with Kaiser Normalization was used. This method generated 10 factors that accounted for 66% of the variability in the way people respond. This sorted the items in relation to the factors into the most usable groups. The groupings are more reliable when items are not sorted across several factors; it is best to have a discrete group of items associated with one factor. After examination of the survey questions identified for each factor, the researcher labeled these factors. See Tables 5 through 14 for a complete listing of the factors and the survey items that loaded to that factor. A brief description of the results follows each table. Further discussion is presented in Chapter 5.

Table 5.

Factor One: Development of practice through interaction with colleagues

Factor loading	Survey Question
.93	I had adequate time to meet with my colleagues to share map reviews in small groups.
.90	I met with small groups of colleagues to discuss map reviews.
.87	I reviewed groups of my colleagues' maps beyond my grade level.
.87	I had adequate time to review groups of maps.
.83	I had guidelines to follow when meeting with my colleagues to share map reviews in small groups.
.79	I reviewed groups of my colleagues' maps at my grade level within my building.

(*table continues*)

Factor loading	Survey Question
.77	I participated in a large group meeting where we shared small group reviews with the faculty.
.71	I had adequate preparation and guidance to review other teachers' maps.
.62	I participated in creating an action plan to address issues from the large group review.
.58	I reviewed groups of maps from those outside my building.
.35	I had adequate time to complete my individual maps.
.32	I used the Reports feature of the curriculum mapping software program to assist with the curriculum mapping review process.
.30	The curriculum mapping software tool helped me and my colleagues to communicate and collaborate more effectively about our maps.

Teachers need more time, opportunities and guidance to meet collegially in order to grow the practice of curriculum mapping. Curriculum mapping software allows for the generation of data to be used in these collegial meetings.

Table 6

Factor Two: Teacher Perceptions Related to Benefits and Value of the Innovation

Factor loading	Survey Question
.94	I believe that curriculum mapping can improve education in South Dakota.
.93	Curriculum mapping will benefit the teaching practice of the teachers at my building.
.92	Curriculum mapping has long term positive effects on instructional design and delivery.
.82	I want to be involved in the curriculum mapping initiative.
.76	Analyzing the curriculum mapping data provides the basis for making curricular and professional development decisions.
.66	I have a good understanding of the long term benefits of curriculum mapping.
.56	I have a good understanding of how to continually use my curriculum maps to inform my teaching.
.50	My colleagues are supportive of the curriculum mapping initiative.
.43	Curriculum maps and curriculum mapping reports generated using TechPaths allows for more efficient comparison and analysis of mapping data.
.36	TechPaths has helped me more effectively develop and use curriculum maps.

Teachers report that curriculum mapping is beneficial to practice and has potential to provide educational benefits to student. Teachers could benefit from greater understanding of how to use curriculum maps to inform teaching and to analyze data.

Table 7

Factor Three: Confidence in Use of the Technology Tools of the Innovation

Factor loading	Survey Question
.91	I know how to use the reports function of TechPaths
.88	I know how to use the search function of the TechPaths software program
.87	I have used the search function of TechPaths to analyze curriculum mapping data.
.85	I have used the reports function of TechPaths to analyze mapping data.
.73	I feel confident using the TechPaths software program.
.61	Curriculum maps and curriculum mapping reports generated using TechPaths allows for more efficient comparison and analysis of mapping data.
.60	I was adequately trained to use the TechPaths software program to enter my curriculum mapping data
.56	The TechPaths personnel were responsive and helpful with my software problems and/or questions.
.50	TechPaths has helped me more effectively develop and use curriculum maps.
.49	I used the Reports feature of the curriculum mapping software program to assist with the curriculum mapping review process.

Teachers can effectively and confidently use the software for basic curriculum mapping functions. They could benefit from more training in advanced features of the software in order to make the best use of the curriculum mapping data.

Table 8

Factor Four: School Leadership and Knowledge of the Innovation

Factor loading	Survey Question
.897	The administrator(s) in my building is supportive of the curriculum mapping initiative.
.895	The administrator(s) in my building is knowledgeable of the curriculum mapping initiative.
.850	The administrator(s) in my building understands the curriculum mapping process.

Teachers know very little about what their administrators know. The curriculum mapping initiative could benefit from better communication between school leaders and other school personnel.

Table 9

Factor Five: Teacher Understanding of Advanced Methods of the Innovation

Factor loading	Survey Question
.909	I have included essential questions on my maps.
.890	I had formal training to design essential questions.
.553	I have had adequate consensus/core map training.
.391	I understand how to use the mapping data in tandem with standardized test data results.
.310	I have a good understanding of how to sustain curriculum mapping beyond the initial cycle.

Most teachers have not used the advanced methods of the innovation to their full capacity. This could be due to the fact that some schools were surveyed after only one or two years of the implementation. Perhaps more time with the software and process will lead to advanced use.

Table 10

Factor Six: Preparation for Implementation of the Innovation

Factor loading	Survey Question
.808	I attended a curriculum mapping introductory meeting that clearly described the curriculum mapping process before I attended a formal curriculum mapping training.
.693	The curriculum mapping process (which includes creating a map, reviewing maps, participating in small and large group sharing and developing an action plan) was effectively introduced before I got started.
.691	I had a clear understanding of the curriculum mapping process before I created a curriculum map.
.589	I was involved in the decision to implement curriculum mapping in my building.

While the majority of respondents attended introductory meetings to prepare for implementation of the initiative, only half reported having a clear understanding of the process before they began. Very few were involved in the initial decision to engage in the curriculum mapping initiative.

Table 11

Factor Seven: Teacher Self-Report of Implementation

Factor loading	Survey Question
.808	I independently completed a curriculum map that includes content, skills and assessments for every class I teach.
.661	When I created my curriculum map I journal/diary mapped (recorded the curriculum content, skills and assessments at the end of each month as I completed my teaching).
.575	When I mapped my curriculum I created projection maps (recorded the curriculum content, skills and assessments for an entire year at one time.)

Teachers varied in their use of diary mapping and projection mapping to complete a curriculum map. Only slightly more than half of the teachers reported that they completed a curriculum map for every class they teach.

Table 12

Factor Eight: Understanding of Curriculum Alignment and TechPaths

Factor loading	Survey Question
.325	4.13 I have a good understanding of how to continually use my curriculum maps to inform my teaching.
.784	4.8 My curriculum maps are aligned to the South Dakota Student Academic Standards.
.547	5.9. I participated in an on-site TechPaths training session.
.425	4.9 I understand how to use the mapping data in tandem with standardized test data results.
.387	4.10 I have a good understanding of how to sustain curriculum mapping beyond the initial cycle.

More than 80% of teacher report that their maps are aligned to standards. Although teachers have some understanding of how to use the mapping data to inform teaching, they could benefit from more information about how to use the data with standardized test and from more information about how to sustain the initiative.

Table 13

Factor Nine: Supporting the Innovation with Distributed Leadership

Factor loading	Survey Question
.809	A curriculum mapping leadership team comprised of representative staff members is identified at my building.
.794	My building principal is an informed member of the building leadership team.

Teachers do not have adequate information about the status of a curriculum mapping leadership team. Additionally, teachers have limited information in regard to administrative involvement.

Table 14

Factor Ten: Teacher Perceptions of Time Allotted for Integration of the Innovation

Factor loading	Survey Question
.376	I participated in a large group meeting where we shared small group reviews with the faculty.
.365	I participated in creating an action plan to address issues from the large group review.
.364	I reviewed groups of maps from those outside my building.
.359	I used the Reports feature of the curriculum mapping software program to assist with the curriculum mapping review process.
.431	I had adequate time to complete my individual maps.

The final factor varies from the others in that all of the items are inversely correlated with the question related to time. Overwhelmingly, teachers want more time to meet collegially for mapping purposes.

This concludes the presentation of the results from the analysis. Descriptive statistics were presented for subsets of survey questions related to the tool and method of curriculum mapping. Results of the factor analysis which relates to the theory of curriculum mapping were also offered. Chapter 5 contains discussion of the results of this research and provides recommendations for further study.

CHAPTER 5

This chapter contains a discussion of the results presented in Chapter 4. The discussion of the results is presented in three modes. First the results are integrated into a summary of the content of the literature. Next the results are discussed further in terms of the three research questions related to tool, method and theory and this is applied to the conceptual framework. Finally, the results are discussed in relation to the implications and recommendations for practice.

The following section contains a brief summary of the purpose and problem of the study. Additionally it contains the research questions and a discussion of the results in relation to the literature.

Summary of Purpose

The purpose of this study was to understand more about the tools, methods and theory behind teachers' use of a technology-based tool and process to align K-12 curriculum with state standards. The problem that prompted the study is that thousands of teachers in all fifty Unites States are attempting to improve the alignment of curriculum and instruction to standards with curriculum mapping. This effort is due largely to pressure to perform well on high stakes tests that are aligned to standards (Daggett, 2000; Lauer et al., 2005; Popham, 2001; Webb, 2007). Currently there is little research or empirical evidence to help the educational communities understand the tools, methods and the theoretical framework of the tools. Teachers have been given a mandate to align curriculum but have not been provided with tools or strategies to fulfill the mandate.

These research questions guided the study:

1. To what extent are teachers able to use the TechPaths curriculum mapping software in order to create instructional units of study that are internally aligned with prescribed content standards in a northwestern state?
2. To what extent do teachers using TechPaths report increased understanding about how instruction aligned to standards improves practice and influences student
3. What are the factors that represent the underlying constructs of curriculum mapping and how do they correspond to the elements of organizational change presented in the conceptual framework?

Comparison of Literature in Relation to Findings

Chapter 2 of this study presented the relevant literature related to curriculum, content standards, curriculum alignment and teacher use of technology for curriculum development. The following section summarizes the literature in relation to the results of the study. Additional discussion of the results occurs later in the chapter.

Curriculum. Curriculum defines the path that students take during the course of a K-12 journey. At the present time, curriculum is organized based on standards and the standards-based reform that is the driving force in education policy strategy in this country (Finn et al., 2006; Marzano & Kendall, 1996; Peters, 2004; Ravitch, 1995; Rudalevige, 2003). From the results of this study it appears teachers may be using the curriculum mapping software to plan and organize curriculum in schools in a northwestern state.

While it appears teachers in this study may be working in a fashion that is consistent with the prevailing policy on standards-based education, it is unclear from the results of this study if the intentions of the organization in regard to standards-based education and curriculum mapping are being clearly communicated to members of the teaching staff (Peters, 2004; Ravitch, 1995; Ray, 1991). The results of several survey questions in this study indicate there may be a lack of communication about the role of district policies and procedures in terms of supporting curriculum mapping. The literature indicates it is important for staff to have a clear picture of the direction of the organization (Bailey & Pownell, 1998; Ray, 1991).

Content standards. Content standards define what students should know and be able to do at the end of a unit of study. Over the past two decades, a plethora of standards have been developed by numerous national level organizations, special interest groups, state departments of education and local school districts. In this study it appears that teachers are aligning curriculum maps to content standards. The literature relates concerns that there are too many standards and too many that are poorly conceptualized (Brandt, 1995; Eisner, 1995; Popham, 1997, 2006; Schmoker & Marzano, 1999; Wolk, 1998). This has resulted in a situation where teachers must choose, on their own, what they think is most important and when the target is a mile wide, teachers do not know where to aim their instructional efforts (Jacobs, 2004; Marzano & Kendall, 1997; Popham, 2006; Ravitch, 1995; Schmoker, 2006). In this study it appears that teachers may be making instructional decisions based on standards which could serve the purpose of narrowing instructional focus, however this study did not examine the quality of standards that teachers are using for alignment purposes. As a result it is not possible to tell if they are aiming their instructional efforts at the most appropriate target.

Curriculum alignment. In order for standards to be implemented in the classroom they must be aligned to instruction. Schlechty (2001) suggests that curriculum alignment assures that what is valued is what gets taught because alignment means the content and skills that are relevant and agreed upon by the community are embedded in the work which students perform. About 50% of respondents in this study agree that curriculum mapping has long term benefits and that it has positive effects on instructional design and delivery. This is consistent with the research that indicates an aligned curriculum is associated with increased student achievement (Hamilton et al., 2007; Kercheval & Newbill, 2000; Waters et al., 1995). It is undetermined if respondents associate this benefit with research related to alignment and student achievement. It could be beneficial to investigate this further to determine the reasons teachers in this survey believe curriculum mapping is beneficial.

While there is a clear emphasis for teachers to deliver curriculum that is guided by prescribed standards, educators lack methods, guidance and appropriate strategies to align these standards with instruction (Marzano & Kendall, 1997; O'Shea, 2005; Webb, 2007). According to the literature, curriculum mapping is one of the methods educators are using to achieve the goal of alignment to standards (Huffman, 2002; Jacobs, 1997; Koppang, 2004;

Lucas, 2005). Teachers in this study overwhelmingly agree (93%) that curriculum mapping software facilitates the mapping process. This is an interesting result in light of the finding that indicates only about half of the respondents have completed an individual curriculum map. It seems odd that teachers would report that the software works for the mapping process, yet many have not used it to accomplish this task. These results do correspond with demographic information that indicates approximately one-third of the teachers reported very little and no experience with curriculum mapping. Perhaps some respondents have not progressed to a point in the curriculum mapping process where they have gained the necessary experience to be comfortable with the technology (Bailey & Pownell, 1998; Brand, 1998; U.S. Congress, 1995). In some instances completing one curriculum map can take an entire year which would may help explain the rate of completion (Udelhofen, 2005).

Alignment tools. Curriculum mapping is a calendar-based reporting process teachers utilize to record what is taught, when it is taught, how they assess what has been taught, and how what they are teaching relates to content standards. Once teachers have accurately recorded a picture of the operational, or taught curriculum, the curriculum mapping process continues through a series of defined steps that allow teachers to engage in structured dialogue to review, discuss, analyze and make informed curricular decisions based on data (Jacobs, 2004; Udelhofen, 2005). It appears that teachers in this study have learned to use the tool to enter basic mapping data, but they remain largely unprepared to use advanced features so they are not able to generate the reports necessary to inform their own instructional practices or to facilitate collegial conversations. According to the literature it is necessary for teachers to have confidence in their use of technology for it to be effective (Bailey & Pownell, 1998; Ray, 1991). Despite a shortage of advanced feature skill use, it appears that more than half of the teachers in this study may be effectively developing maps and more than four-fifths of them may have aligned the maps to content standards. Curriculum mapping is an ongoing and cyclical process intended to keep curriculum up-to-date, to ensure coverage of essential standards-based content for all students and to provide a scheduling mechanism to ensure there is enough time to cover that content (Jacobs, 2004; Udelhofen, 2005). In this study it appears that teachers are utilizing the calendar-based software to organize curriculum in order to cover the prescribed content standards.

Teachers using technology. The proliferation of curriculum mapping is largely due to the new technologies that are available to assist the endeavor. The history of technology in schools would indicate that technology rarely influences the actual processes of teaching and learning. Instead the technologies are absorbed into current practices (Papert, 1998). Because this study is exploratory in nature it is not yet apparent if curriculum mapping has been integrated into the teachers' culture and practice. Initial results indicate teachers may be learning new skills and they may be learning new methods that they may utilize to perform the processes of curriculum mapping which could potentially serve to influence the deep learning cycle (Senge et al., 1994). The literature indicates communication technologies as one area in which new technologies have been heavily utilized by educational personnel (U.S. Congress, 1995). With the increased ability for communication comes a need for knowledge management. When information is shared among or between people, each party gains in their understanding and creates knowledge based on their interaction and experience with the new information (Petrides & Nodine, 2003). This literature is consistent with results of this study in that curriculum mapping can be considered a form of knowledge management. The related software makes the process efficient because elements of the curriculum are entered into a database. The database allows for anytime, anywhere, real-time access to curriculum data across a school district. Teachers surveyed in this study reported evidence of sharing data with colleagues. It appears about half reviewed groups of colleagues' maps at grade level and beyond grade level. It appears that a lesser number reviewed groups of maps outside their own building. Less than half reported that they were adequately prepared to engage in this review process and respondents indicate they need more time to meet with colleagues to utilize the mapping data. The need for adequate time is supported by the literature related to staff development needs in relation to technology tools (Bailey & Pownell, 1998; Brand, 1998).

The software companies that produce this software claim that curriculum mapping improves student achievement, but currently there is insufficient empirical evidence to support this claim. A majority of respondents indicated that curriculum mapping may improve education in the state and benefit the teaching practice.

Relationship of Results to Tool, Method and Theory Research Questions

The previous discussion and conclusions were presented based on an understanding of the literature which conveyed information about curriculum, content standards, curriculum alignment and teacher use of technology tools. In addition to the literature base, the conclusions are presented here in terms of the three research questions that relate specifically to discrete elements of the conceptual framework presented in Chapter 1. These elements are the tools, methods and theories related to curriculum mapping. Conclusions about each element are presented and then an overall discussion of how these three sets of results interrelate and connect to the larger conceptual framework.

The curriculum mapping tool. The tool in this study was the curriculum mapping software. The study was limited to participants in school districts using TechPaths curriculum mapping software, a product of Performance Pathways, because this was the software provided free for teachers in schools in a northwestern state. The results of the analysis inform the research question. To what extent are teachers able to use the TechPaths curriculum mapping software in order to create instructional units of study that are internally aligned with prescribed content standards in a northwestern state?

The results of the analysis indicate the vast majority of teachers may have the software and may have been trained. Interestingly all the participants in this survey should have had access to software because only teachers in districts that reported they were using the software were included in this study. This may be related to the demographic information associated with the level of experience and background where approximately one-third reported very little and no experience with curriculum mapping. It appears nearly half are not skilled in use of some features of the software or it is possible they may have not progressed to a point in the curriculum mapping process where they have needed to learn to use these features. The first stage of mapping is to enter the curriculum data and sometimes this is done in a diary-mapping process where teachers spend an entire year recording curriculum data (Jacobs, 1997). It is likely teachers in this study may utilize the advanced feature of report creation to a greater extent after the initial entry of data.

Despite a shortage of advanced feature skill use, it appears more than half are effectively developing maps and more than four-fifths of them have aligned the maps to content standards. This is promising given the fact that participants in schools have only been mapping for one or two years. It appears that the software is helpful in the development of maps and it may be very helpful in aligning instruction to content standards. It appears nearly three-fourths attended training sessions but participants would probably benefit from more training given the reduced percentages in the reports of adequacy and confidence. In this study it generally appears the tool is working well for the intended purpose of aligning instruction to standards and organizing curriculum.

The curriculum mapping method. The method was the process of curriculum mapping as described in the literature. The curriculum mapping process is calendar-based and records what is taught, when it is taught, how teachers assess what has been taught, and how what they are teaching relates to content standards. Once teachers have recorded the data, the curriculum mapping process continues with structured dialogue to review, discuss, analyze and make informed curricular decisions based on data (Jacobs, 1997; Udelhofen, 2005). The results of the analysis relate to the second research question. To what extent do teachers using TechPaths report increased understanding about how instruction aligned to standards improves practice and influences student achievement?

It appears about half attended a preparatory meeting and gained an understanding of the process before it began. These results are interesting because they do not correspond with the background information of the project that reports a vast majority of schools surveyed received grant funds to engage in the mapping process. It is possible the teachers were paid for professional development time to do the mapping but they did not engage in the pre-work to understand the reason for engaging in this process. Perhaps expanded communication about the purpose of the mapping initiative at the school or district level could provide benefits. It appears that it is not an ideal situation to have more than half of respondents reporting that they don’t know if their district has policies to support the initiative. It is interesting that only about half the respondents have completed an individual map. This may be due to the fact the many respondents were still in year one when they completed the survey and if they were diary mapping they may not have completed a full map. With about half of the respondents having completed this first step of the curriculum mapping method, it is sensible that about half feel they understand the benefits of mapping and believe it can positively affect instruction.

Building a theory of curriculum mapping. This study attempted to identify constructs that could assist to build the foundation for a theory about curriculum mapping. A set of factors were identified using a factor analysis process. The analysis identified 10 factors based on data from 53 survey questions. The 10 factors were: a) collegial work and communication, b) benefits and value of curriculum mapping, c) software use and training, d) administrative support, e) advanced curriculum mapping processes, f) preparation and understanding of curriculum mapping method, g) status of individual curriculum map completion, h) alignment of standards and use of data, i) leadership team, and j) time to perform curriculum mapping processes.

It appears the survey questions that influenced the collegial work and communication factor indicate that teachers may need more time and guidance to accomplish this work. Considering the analysis of questions related to the curriculum mapping method, it is possible they may not have entered enough mapping data to get to a point where it is effective to meet collegially and discuss data. If this is not the case then perhaps more time and guidance should be provided.

In this study it generally appears that teachers were prepared to curriculum map, understood the mapping method and may be producing their own curriculum maps that are aligned to content standards. It appears nearly two-thirds were not involved in the decision to be part of the curriculum mapping initiative. According to the change literature it would be advisable to have more shared understanding and a guiding coalition in place before engaging in an initiative (Kotter, 1996).

Survey questions that influenced the benefits and values factor generally indicate that teachers think curriculum mapping is valuable for improving education and may assist them to make sound curricular decisions, however they may need more training and guidance in the use of advanced features to move them beyond the initial phase of just entering the data. This observation may be confirmed by the questions that make up the factor called advanced curriculum mapping processes. These advanced features provide the reports necessary to have meaningful collegial conversations (Udelhofen, 2005). Without an increase in skills related to software use, it is unlikely teachers will have the tools they need to engage in meaningful collegial dialogue (Bailey & Pownell, 1998).

It appears the survey questions related to the administrative support factor indicate that teachers don't know what their administrators know about mapping. If administrators are knowledgeable about and understand the curriculum mapping process, perhaps they may not be communicating this to teachers. The initiative could possibly benefit from more communication between administrative and teaching staff (Bailey & Pownell, 1998).

A factor that may be related to administrative support is the leadership team factor. In this case the results indicated that while about half know there is a leadership team and that their administrator is part of this team, it appears that about one-fourth don't know. These two factors correspond with what this researcher is calling the hidden factor. The hidden factor is made up of the questions that were deleted before the factor analysis. These questions were deleted because the nature of the survey questions were such that teachers could not realistically be expected to readily know information about what administrators, leadership teams and curriculum directors were doing in relation to mapping. Although teachers might not be expected to know this information in the beginning stages of the process, it would seem logical that at some point more of this information is communicated in order to build some shared understanding of the purposes and processes of mapping (Ray, 1991). This is consistent with the literature that indicates administrative support and confidence are essential for successful implementation of technology tools (Bailey & Pownell, 1998).

Results indicate that survey questions related to time were inversely correlated with survey questions associated with the factors related to learning advanced features and meeting with colleagues. It appears teachers could benefit from more time to engage in these activities so that they might be more skilled in the use of the tool and better able to accomplish the methods and processes of curriculum mapping. This result is supported by the literature related to time necessary to learn tools (Bailey & Pownell, 1998). This concludes the discussion of the results of the tool, method and theory of curriculum mapping.

Conceptual framework relationships. The three research questions were organized in relation to the conceptual framework presented in Chapter 1. The intention of the study was to focus on tool, method and theory, but the results will also be related to the larger framework which consists of the organizational architecture and the deep learning cycle where appropriate.

This researcher believes the hidden factor along with administrative support, leadership team factors and the time factor may be related to innovations in infrastructure that help support organization architecture. These factors are key to the successful introduction of theory, methods and tools (Arbuckle, 1994; Bailey & Pownell, 1998; Ray, 1991; Senge et al., 1994). The infrastructure should support people in doing their work. In this study it appears the infrastructure has supported the tool and professional development time to learn to use the basic features of the tool, like creating maps, but more time is needed for educators to understand the theory, or reason they are using software to create alignment and to situate this new learning within guiding ideas. Additionally it appears they need more time to learn advanced features to generate data sets that will enable and support reflective and collaborative time for teachers to discuss the practice.

Tools must be congruent with an underlying theory (Arbuckle, 1994; Senge, 2000). In this instance the tool, curriculum mapping software, is functioning well in terms of assisting teachers to map and align instruction to content standards. There is some concern that teachers don’t fully understand the reason or the theory that is guiding this activity although they think it will benefit instruction and education in general. So while the tool use may be congruent with the guiding ideas of the organizational architecture, the results of the study indicate there is not generally a good grasp of the theory that supports the use of the tool. It appears teachers are using the tool to accomplish the method of curriculum mapping and they report they generally have an understanding of the method. However, it appears they either have not progressed in the process far enough to complete the curriculum mapping cycle or they just haven't had adequate time to do this.

It appears likely that the tool, method and theory of curriculum mapping have begun to influence the deep learning cycle for some teachers since survey items indicate they have acquired skills and capabilities in terms of mapping. It will likely take more time and more research to decide if this acquisition will result in new awareness and sensibilities that alter views of structures or behavior and in turn result in new attitudes or beliefs.

Limitations of the Study

This study was limited to teachers in a northwestern state using one type of curriculum mapping software tool. A possible limitation of this study is that it relies on teacher perceptions about curriculum mapping and alignment. By manipulating the software one can indicate that instruction is aligned, but it would take further in-depth study and classroom observation to confirm this. This study is valuable in that it provides the initial piece of evidence indicating teachers think curriculum maps are assisting with alignment. This may set the stage for further research related to curriculum mapping and alignment.

Recommendations for Practice

The purpose of this study was to understand more about the tools, methods and theory behind teacher use of a technology-based tool and process to align K-12 curriculum with state standards. The following recommendations for practice emerged from the results and conclusions of the study. They are as follows:

1. Strengthen the innovations in infrastructure necessary to support the tools, methods and theory. There needs to be more communication between administrative staff and teachers. Teachers need more time to learn to use the tool and to meet with colleagues.
2. More training in the advanced features of the software should be conducted so that these features can be used to facilitate the processes of curriculum mapping that involve communication and collaboration with colleagues.
3. Teachers could benefit from having a greater understanding of why they are mapping and the research related to curriculum and alignment. More professional development should be conducted to develop this understanding.

Recommendations for Further Study

The following recommendations for further study emerged from the results and conclusions of the study:

1. Conduct studies in schools that reported supportive innovations in infrastructure to determine the extent to which this factor influences the

curriculum mapping process and to describe specific practices that built the supporting infrastructure.

2. Conduct studies specific to the best practices of curriculum mapping software training to provide information that would give trainers the best progression for learning to use the software features in tandem with the method and process of curriculum mapping.
3. Qualitative studies should be conducted to investigate teacher perceptions related to the purpose of mapping.
4. Teachers in this study reported that curriculum mapping is beneficial to education. It could be beneficial to investigate this further to determine the reasons teachers in this survey believe curriculum mapping is beneficial.
5. Studies should be conducted to determine if the content, skills and assessments in curriculum maps that teachers perceive as being aligned with content standards are actually aligned and administered as described in the maps.

REFERENCES

Apple, M. W. (1986). Teachers & texts: A political economy of class & gender relations in education. New York: Routledge & Kegan Paul.

Apple, M. W., & Christian-Smith, L. K. (Eds.). (1991). *The Politics of the Textbook*. New York: Routledge.

Arbuckle, M. (1994). The fifth discipline: The art and practice of the learning organization. In P. Senge (Ed.), *Schools that learn: A fifth discipline fieldbook for educators, parents, and everyone who cares about education* (pp. 593). New York: Doubleday.

Bailey, G. D., & Pownell, D. (1998). Technology staff-development and support programs: Applying Abraham Maslow's hierarchy of needs. *Learning and Leading with Technology, 26*(3), 47-51,64.

Brand, G. (1998). What research says: Training teachers for using technology. *Journal of Staff Development, 19*(1).

Brandt, R. (1995). What to do with those new standards. *Educational Leadership, 52*(6), 5.

Budan, K. (2005). A guide for structuring teacher collaboration using TechPaths curriculum mapping data. Unpublished whitepaper. Performance Pathways.

Buttram, J. L., & Waters, J. T. (1997). Improving America's schools through standards-based education. *National Association of Secondary School Principals. NASSP Bulletin, 81*(590), 1.

Cohen, D. K. (1988). Educational technology and school organization. In R. S. Nickerson & P. P. Zodhiates (Eds.), *Technology in education: Looking toward 2020*. Hillsdale, NJ: Lawrence Erlbaum Associates

Coleman, J. S. (1966). *Equality of Educational Opportunity (Coleman) Study* Retrieved. from http://www.icpsr.umich.edu/cocoon/ICPSR/STUDY /06389.xml

Collaborative Learning Inc. (2007). Why are schools and districts in all fifty states mapping their curriculum? Retrieved January 24, 2007, from http://www.clihome.com/CM/Home.asp#

Creswell, J. C. (2003). Research design: qualitative, quantitative and mIxed methods approaches. Thousand Oaks, CA: Sage Publications.

Cuban, L. (1993a). Computers meets classroom: Classroom wins. *Teachers College Record, 95*(2), 185-210.

Cuban, L. (1993b). The lure of curricular reform and its pitiful history. *Phi Delta Kappan, 75*(2), 181-185.

Cuban, L. (1995). The hidden variable: How organizations influence teacher responses to secondary science. *Theory Into Practice, 34*(1), 4.

Daggett, W. R. (2000). Moving from standards to instructional practice. *National Association of Secondary School Principals. NASSP Bulletin, 84*(620), 66.

Danielson, C. (2002). *Enhancing student achievement: A framework for school improvement*. Alexandria, VA: Association for Supervision and Curriculum Development

Davenport, T. H., & Prusak, L. (2000). *Working knowledge: How organizations manage what they know* (2nd ed.). Boston: Harvard Business School Press.

Deets, J. (2000). Maps and curriculum decision making. *Journal of Curriculum and Supervision, 15*(4), 359-371.

Drake, S., & Burns, R. (2004). *Meeting standards through integrated curriculum* (1st ed.). Alexandria, VA: Association for the Supervision and Curriculum Development.

Eisner, E. W. (1995). Standards for American schools: Help or hindrance? *Phi Delta Kappan, 76*(10), 758.

English, F. (1980). Curriculum mapping. *Educational Leadership, 37*(7), 558-559.

English, F. (2000). Deciding what to teach and test: Developing, aligning and auditing the curriculum. Thousand Oaks, CA: Corwin Press.

English, F., & Steffy, B. (2001). Deep curriculum alignment: Creating a level playing field for all children on high-stakes tests of educational accountability: Scarecrow Press.

Finn, C. E., Jr., Julian, L., & Petrilli, M. J. (2006). *The state of state standards, 2006*: Thomas B. Fordham Foundation & Institute.

Foshay, A. W. (1991). The curriculum matrix: Transcendence and mathematics. *Journal of Curriculum and Supervision, 6*(4), 277-293.

Fuhrman, S. H. (Ed.). (2001). *From the capitol to the classroom: Standards-based reform in the states* (1 ed.). Chicago: The University of Chicago Press.

Gardner, D. P. (1983). *A nation at risk: The imperative for educational reform*. Washington D.C.: U.S. Government Printing Office.

Goldstein, L. S. (1998). Echoes and departures: Foshay's curriculum matrix and trends in the field of curriculum theory.

Hamilton, L. S., Stecher, B. M., Marsh, J. A., McCombs, J. S., Robyn, A., Russell, J., et al. (2007). *How educators in three states are responding to standards-based accountability under No Child Left Behind*. Santa Monica, CA: RAND Corporation.

Harden, R. M. (2001). AMEE Guide No. 21: Curriculum mapping: A tool for transparent and authentic teaching and learning. *Medical Teacher, 23*(2), 123.

Huffman, S. S. (2002). *Middle school teachers' perceptions of the value and efficacy of curriculum mapping and state standards.* Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign, Illinois.

International Society for Technology Education. (2007). National Educational Technology Standards Project. Retrieved December 10, 2007, 2007, from http://www.iste.org/AM/Template.cfm?Section=NETS

Jacobs, H. H. (1997). *Mapping the big picture: Integrating curriculum and assessment k-12*. Alexandria, VA: Association for Supervision and Curriculum Development.

Jacobs, H. H. (2003). Connecting curriculum mapping and technology: Digital forms aid data analysis and decision making. *Technology Quarterly, 12*(3), 1-4.

Jacobs, H. H. (2004). *Getting results with curriculum mapping*. Alexandria, VA: Association for Supervision and Curriculum Development.

Kercheval, A., & Newbill, S. (2000). *A case study of key effective practices in Ohio's Improved school districts*. Bloomington: Indiana Center for Evaluation.

Koppang, A. (2004). Curriculum Mapping: Building collaboration and communication. *Intervention in School and Clinic, 39*(3), 154.

Kotter, J. P. (1996). *Leading change* (1st ed.). Boston: Harvard Business School Press.

Lauer, P. A., Snow, D., Martin-Glenn, M., Van Buhler, R. J., Stoutemyer, K., & Snow-Renner, R. (2005). The influence of standards on k-12 teaching and student learning: A research synthesis (pp. 194). Aurora, CO: Mid-continent Research for Education and Learning.

Lewis, A. C. (1995). An overview of the standards movement. *Phi Delta Kappan, 76*(10), 744.

Lucas, R. M. (2005). Teachers' perceptions on the efficacy of curriculum mapping as a tool for planning and curriculum alignment. Unpublished doctoral dissertation, Seton Hall University, New Jersey.

Marzano, R. (1999). Building curriculum and assessment around standards. *High School Magazine, 6*(5), 14-19.

Marzano, R. (2003). *What works in schools: Translating research into action*. Alexandria, VA: Association for Supervision & Curriculum Develpment.

Marzano, R., & Kendall, J. (1996). *The fall and rise of standards-based education*. Alexandria, VA: Mid-Continent Regional Educational Lab.

Marzano, R., & Kendall, J. (1997). National and state standards: The problems and the promise. *National Association of Secondary School Principals. NASSP Bulletin, 81*(590), 26.

Maslow, A. H. (1999). *Toward a psychology of being* (3rd ed.). New York: John Wiley & Sons.

Mondale, S., & Patton, S. B. (Eds.). (2001). *School: The story of American public education* (1 ed.). Boston: Beacon Press.

National Commission on Teaching & America's Future. (1996). *What Matters Most: Teaching for America's Future* (No. ISBN-0-9654535-0-2). Woodbridge, VA.

Nickerson, R. S., & Zodhiates, P. R. (Eds.). (1988). *Technology in education: Looking toward 2020* (1st ed.). Hilldale, NJ: Lawrence Erlbaum Associates.

Norman, D. A. (1988). *The design of everyday things*. New York: Basic Books.

O'Shea, M. R. (2005). Planning & assessing standards achievement: Schools must provide teachers with strategies they can use to efficiently turn school standards resources into standards-achieving instruction. *Leadership, 35*(2), 26-Dec.

Papert, S. (1993). The children's machine: Rethinking school in the age of the computer. New York: BasicBooks.

Papert, S. (1998). Technology in schools: To support the system or render it obsolete. Retrieved March 27, 2008, from www.mff.org

Performance Pathways. (2007). Our community. Retrieved January 24, 2007, from http://www.techpaths.com/OurCompany/Ourcommunity/tabid/145/Default.aspx

Peters, B. G. (2004). *American public policy* (6 ed.). Washington, DC: CQ press.

Petrelli, M., & Hess, F. M. (2006). Whither the Washington consensus [Electronic Version]. *The Education Gadfly*, *6*. Retrieved March 5, 2008 from http://www.edexcellence.net/foundation/gadfly/issue.cfm?edition=&id=244#2863

Petrides, L., & Nodine, T. (2003). Knowledge management in education: Defining the landscape. Retrieved April 2, 2006, from http://www.iskme.org/kmeducation.pdf

Pierce, D. (2007). Experts: Ed tech must change its message [Electronic Version]. *eSchool News*. Retrieved June 15, 2008 from http://www.eschoolnews.com/conference-info/cosn/cosn-news/index.cfm?i=45789&page=2

Pogany, W. (2005). A vision for professional development. Unpublished presentation. South Dakota Department of Education.

Popham, W. J. (1997). The standards movement and the emperor's new clothes. *NASSP Bulletin, 81*(590), 21-25.

Popham, W. J. (2001). Teaching to the test? *Educational Leadership, 58*(6), 16-20.

Popham, W. J. (2006). Content standards: The unindicted co-conspirator. *Educational Leadership, 64*(1), 87-88.

Ravitch, D. (1995). *National standards in American education: A citizen's guide*. Washington, DC: Brookings Institution.

Ray, D. (1991). Technology and restructuring--Part II: New organizational directions. *Computing Teacher, 18*(7), 8-12.

Richardson, W. (2006). Blogs, wikis, podcasts, and other powerful web tools for classrooms. Thousand Oaks, CA: Corwin Press.

Rudalevige, A. (2003). The politics of No Child Left Behind. *Education Next, v3 n4 p62-69 Fall 2003*.

Sammons, P., Hillman, J., & Mortimore, P. (1995). Key characteristics of effective schools: A review of school effectiveness research (pp. 39): B & MBC Distribution Services.

Schlechty, P. C. (2001). Shaking up the schoolhouse: How to support and sustain educational innovation. San Francisco: Jossey-Bass.

Schmoker, M. (2001). *The results fieldbook: Practical strategies from dramatically improved schools*. Alexandria, VA: Association for Supervision and Curriculum Development.

Schmoker, M. (2006). *Results now: How we can achieve unprecedented improvements in teaching and learning*. Alexandria, VA: Association for Supervision and Curriculum Development.

Schmoker, M., & Marzano, R., J. (1999). Realizing the promise of standards-based education. *Educational Leadership, 56*(6), 17.

Senge, P. (2000). Schools that learn: A Fifth discipline fieldbook for educators, parents, and everyone who cares about education. New York: Doubleday.

Senge, P., Ross, R., Smith, B., Roberts, C., & Kleiner, A. (1994). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday Dell Publishing Group.

Shanks, D. J. (2002). A comparative study on academic gains between students in second grade through sixth grade before and after curriculum mapping. Unpublished doctoral dissertation, Tennessee State University, Tennessee.

Shelton, M., & Jones, M. (1996). Staff development that works! A tale of four t's. *NASSP Bulletin, 80*(582), 99-105.

Sizer, T. R. (1999). That elusive "curriculum." *Peabody Journal of Education, 74*(1), 161-165.

South Dakota Social Studies Standards. (2006). Retrieved March 10, 2008. from http://doe.sd.gov/contentstandards/social/newstandards.asp

Stadick-Smith, M. (2005). Department of education awards curriculum mapping grants. Retrieved March 16, 2008, from http://doe.sd.gov/pressroom/news.asp?ID=13

Stein, J. (Ed.). (1988). *The random house college dictionary* (10 ed.). New York: Random House.

Stiggins, R., Arter, J. A., Chappuis, J., & Chappuis, S. (2007). *Classroom assessment for student learning: Doing It right -- using It well*. Portland, OR: Assessment Training Institute.

Superfine, B. M. (2005). The politics of accountability: The rise and fall of goals 2000. *American Journal of Education, 112*(1), 34-44.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (Fifth ed.). Boston, MA: Pearson Education.

U.S. Congress. (1995). *Teachers and technology: Making the connection* (No. OTA-EHR-616): U.S. Government Printing Office.

U.S. Congress. (2002). *No Child Left Behind Act*. Retrieved November 2007. from http://www.ed.gov/nclb/landing.jhtml?src=pb

Udelhofen, S. (2005). Keys to curriculum mapping: Practical strategies and tools to make it work Thousand Oaks, CA: Corwin Press.

Vang, C. T. (2005). Minority students are far from academic success and still at-risk in public schools. *Multicultural Education, 12*(4), 9.

Virginia Department of Education. (2000). A study of effective practices in Virginia's schools: Educators' perspectives of effective practices leading to student success on SOL tests. Richmond, Virginia: Division of Accountability Governor's Best Practice Center.

Waters, T., Burger, D., & Burger, S. (1995). Moving up before moving on. *Educational Leadership, 52*(6), 35.

Webb, N. L. (2007). Issues related to judging the alignment of curriculum standards and assessments. *Applied Measurement in Education, 20*(1), 7-25.

Wiggan, G. (2007). Race, school achievement, and educational inequality: Toward a student-based inquiry perspective. *Review of Educational Research, 77*(3), 310-333.

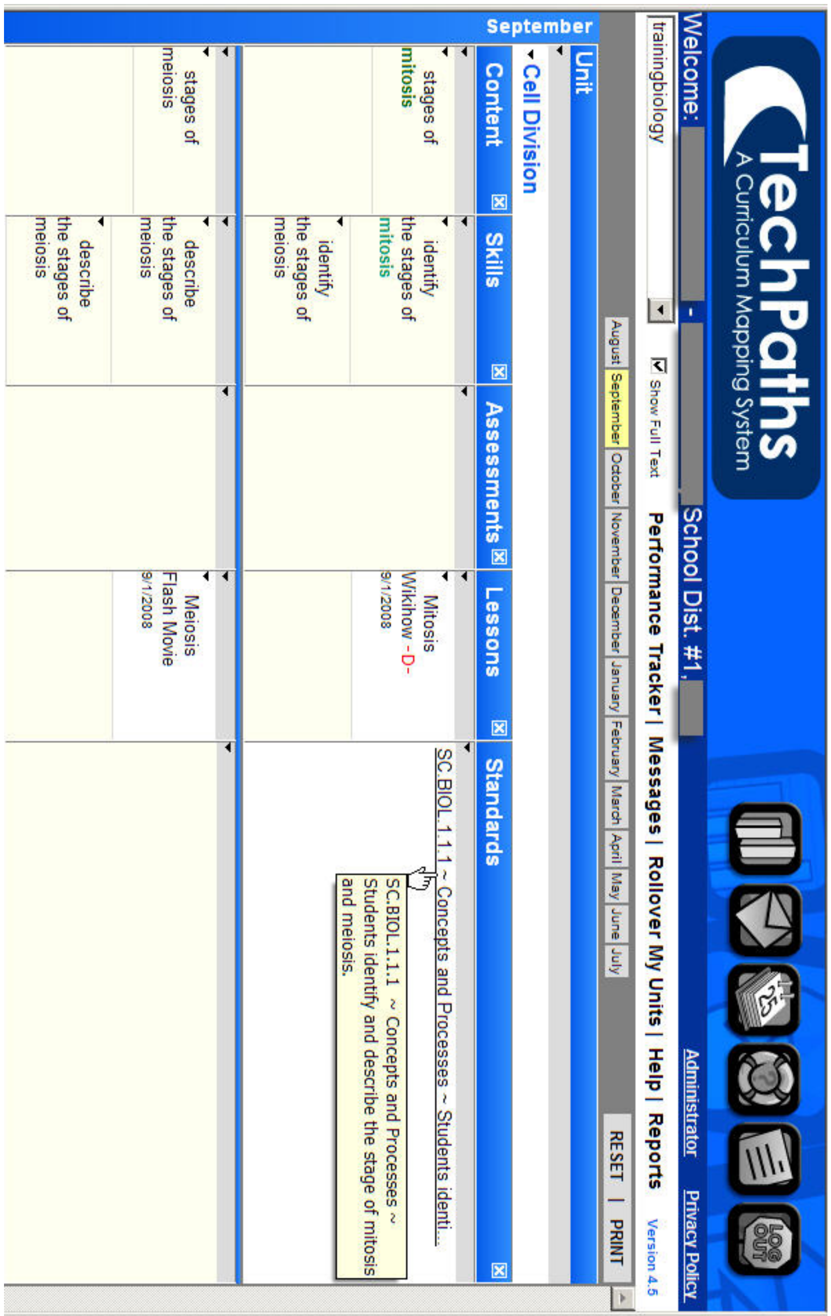
Wiggins, G., & McTighe, J. (2005). *Understanding by design* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Wilansky, J. A. (2006). The effects of curriculum mapping on the instructional practices of professional collaboration, standards alignment, and assessment. Unpublished doctoral dissertation, Dowling College, New York.

Wolk, R. A. (1998). Doing it right. *Teacher Magazine, 10*(1), 6.

APPENDIX A

TechPaths curriculum mapping software screenshot.
Screenshot reproduced with permission of the website owner.



APPENDIX B

Demographic Data collected on Part I of:

A Northwestern State Department of Education
Curriculum Mapping Survey
Spring 2006

Part I: Background Information

Date: ______ ESA #: ___________ District: _____________________________

All responses will be kept confidential. Please fill in the box or answer the question. Return your questionnaire in the enclosed envelope.

1. What is your gender? ☐ *female* ☐ *male*

2. What is your age?
____20-29 _____30 – 39 _____40 – 49 _____ 50+

3. How many years have you been involved in education, including this year?
______

4. Indicate your level of formal education.
   - ☐ BA/BS
   - ☐ BA/BS + 15 Semester Credit Hours
   - ☐ MA/MS
   - ☐ MA/MS +15 Semester Credit Hours
   - ☐ Doctorate

5. What describes your position? *(Choose all that apply)*
   - ☐ **Elementary Level** Classroom Teacher
   - ☐ **District Level** Staff Developer
   - ☐ **Elementary Level** Staff Developer
   - ☐ **District Level** Administrator
   - ☐ **Elementary Level** Administrator

   - ☐ **Middle School Level** Classroom Teacher
   - ☐ **ESA Level** Staff Developer
   - ☐ **Middle School Level** Staff Developer
   - ☐ **ESA Level** Administrator
   - ☐ **Middle School Level** Administrator

☐ **High School Level** Classroom Teacher
☐ **State Level** Consultant
☐ **High School Level** Staff Developer
☐ **State Level** Administrator
☐ **High School Level** Administrator
☐ **Other**

6. What is your level of experience and background in curriculum mapping?

☐ None
☐ Very Little
☐ Some
☐ Quite a Bit
☐ Expert

7. What training/educational opportunities have you engaged in to learn about the process of curriculum mapping? (*check all that apply*)

☐ None
☐ Read Dr. Heidi Hayes Jacobs's book, *Mapping the Big Picture*
☐ Read both Dr. Heidi Hayes Jacobs's book, *Mapping the Big Picture* and *Getting Results with Curriculum Mapping*
☐ Read Dr. Susan Udelhofen's book, *Keys to Curriculum Mapping*
☐ Attended one or more conferences with Dr. Heidi Hayes Jacobs on curriculum mapping
☐ Attended one or more training sessions with Dr. Susan Udelhofen on curriculum mapping sponsored by the state of South Dakota
☐ Attended one or more training sessions on curriculum mapping provided by South Dakota ESA personnel
☐ Attended one or more training sessions with Franz Wolff from Technology Pathways International
☐ Attended the Annual Curriculum Mapping Institute held in Utah in the month of July keynoted by Dr. Heidi Hayes Jacobs and Dr. Bena Kallick
☐ Attended one or more training sessions on curriculum mapping with trainers other than Dr. Heidi Hayes Jacobs that were not sponsored by the state of South Dakota
☐ Attended a training session with Karen Budan at the State Elementary Principals Conference
☐ Attended a training session with Karen Budan at the State Secondary Principals Conference.
☐ Participated in monthly conference call trainings with Karen Budan.

8. From your viewpoint, which of the following best describes your district's position or actions in regards to the state of South Dakota's curriculum mapping initiative?

- ☐ Have no awareness of the curriculum mapping initiative
- ☐ Are aware of the state initiative, but are waiting for more information or direction
- ☐ Are aware of the state initiative, but have chosen not to participate
- ☐ Are aware of the state initiative and have developed an action plan to implement curriculum mapping as a district initiative

9. From your viewpoint, which of the following best describes your school site's position or actions in regards to the state of South Dakota's curriculum mapping initiative?

- ☐ Have no awareness of the curriculum mapping initiative
- ☐ Are aware of the state initiative, but are waiting for more information or direction from the district and/or state
- ☐ Are aware of the state initiative, but have chosen not to participate
- ☐ Are aware of the state initiative and have developed an action plan to implement curriculum mapping as a school site initiative

10. My building is using the following curriculum mapping software program:

- ☐ Curriculum Mapper
- ☐ Rubicon Atlas tent
- ☐ TechPaths (software provided by the state)
- ☐ Other: ___________________________________ (please list)
- ☐ We are not using any curriculum mapping software program

APPENDIX C

Part II and III of:

A Northwestern State Department of Education
Curriculum Mapping Survey
Spring 2006

Part II: Curriculum Mapping Process

SECTION I. PRELIMINARY PREPARATION	1= Strongly Agree 2= Agree 3= Disagree 4= Strongly Disagree NA= Not Applicable DK = Don't Know
1. I was involved in the decision to implement curriculum mapping in my building.	1 2 3 4 NA DK
2. I attended a curriculum mapping introductory meeting that clearly described the curriculum mapping process before I attended a formal curriculum mapping training.	1 2 3 4 NA DK
3. The curriculum mapping process (which includes creating a map, reviewing maps, participating in small and large group sharing and developing an action plan) was effectively introduced before I got started.	1 2 3 4 NA DK
4. I had a clear understanding of the curriculum mapping process before I created a curriculum map.	1 2 3 4 NA DK
5. My school board is adequately informed of the curriculum mapping initiative.	1 2 3 4 NA DK
6. I believe that curriculum mapping can improve education in South Dakota.	1 2 3 4 NA DK
7. I want to be involved in the curriculum mapping initiative.	1 2 3 4 NA DK
8. Curriculum mapping will benefit the teaching practice of the teachers at my building.	1 2 3 4 NA DK
9. My colleagues are supportive of the curriculum mapping initiative.	1 2 3 4 NA DK
10. The administrator(s) in my building is knowledgeable of the curriculum mapping initiative.	1 2 3 4 NA DK
11. The administrator(s) in my building is supportive of the curriculum mapping initiative.	1 2 3 4 NA DK
12. The administrator(s) in my building understands the curriculum mapping process.	1 2 3 4 NA DK

13. A realistic two- and three-year curriculum mapping plan is in place.	1 2 3 4 NA DK
14. A specific timeline was established and communicated before curriculum mapping was to begin.	1 2 3 4 NA DK
15. The curriculum mapping initiative is clearly identified in the district's school improvement plan.	1 2 3 4 NA DK
16. District policies and procedures have been reviewed to ensure they support and do not hinder the curriculum mapping work/processes.	1 2 3 4 NA DK
17. Curriculum mapping is connected to other initiatives and those connections are explicitly explained to staff.	1 2 3 4 NA DK
18. A highly visible and engaged leadership team is in place to lead curriculum mapping efforts.	1 2 3 4 NA DK
19. A curriculum mapping software program is in place to facilitate the mapping process.	1 2 3 4 NA DK

SECTION II. CURRICULUM MAPPING IMPLEMENTATION	1= Strongly Agree 2= Agree 3= Disagree 4= Strongly Disagree NA= Not Applicable DK = Don't Know
1. I independently completed an individual curriculum map that includes content, skills and assessments.	1 2 3 4 NA DK
2. I worked with other teachers at my grade level when I completed my curriculum map.	1 2 3 4 NA DK
3. I independently completed a curriculum map that includes content, skills and assessments for every class I teach.	1 2 3 4 NA DK
4. When I created my curriculum map I journal/diary mapped (recorded the curriculum content, skills and assessments at the end of each month as I completed my teaching).	1 2 3 4 NA DK
5. When I mapped my curriculum I created projection maps (recorded the curriculum content, skills and assessments for an entire year at one time.)	1 2 3 4 NA DK
6. I had adequate time to complete my individual maps.	1 2 3 4 NA DK
7. I reviewed groups of my colleagues' maps at my grade level within my building.	1 2 3 4 NA DK
8. I reviewed groups of my colleagues' maps beyond my grade level.	1 2 3 4 NA DK
9. I reviewed groups of maps from those outside my building.	1 2 3 4 NA DK
10. I had adequate preparation and guidance to review other teachers' maps.	

11. I had adequate time to review groups of maps.	1 2 3 4 NA DK
12. I met with small groups of colleagues to discuss map reviews.	1 2 3 4 NA DK
13. I had adequate time to meet with my colleagues to share map reviews in small groups.	1 2 3 4 NA DK
14. I had guidelines to follow when meeting with my colleagues to share map reviews in small groups.	1 2 3 4 NA DK
15. I used the Reports feature of the curriculum mapping software program to assist with the curriculum mapping review process.	1 2 3 4 NA DK
16 I participated in a large group meeting where we shared small group reviews with the faculty.	1 2 3 4 NA DK
17. I participated in creating an action plan to address issues from the large group review.	1 2 3 4 NA DK
18. A clear action plan was developed to address issues from the large group meeting.	1 2 3 4 NA DK
19. All steps of the initial cycle (creating an individual map, reviewing colleagues' maps, sharing reviews, creating an action plan) of curriculum mapping were implemented as proposed.	1 2 3 4 NA DK
20. Related arts teachers, special education teachers, guidance counselors and media specialists have received curriculum mapping training.	1 2 3 4 NA DK
21. Related arts teachers, special education teachers, guidance counselors and media specialists have a good understanding of their role in the curriculum mapping initiative.	1 2 3 4 NA DK
22. The curriculum mapping software tool helped me and my colleagues to communicate and collaborate more effectively about our maps.	1 2 3 4 NA DK

SECTION III. CURRICULUM MAPPING LEADERSHIP	1= Strongly Agree 2= Agree 3= Disagree 4= Strongly Disagree NA= Not Applicable DK = Don't Know
1. A curriculum mapping leadership team comprised of representative staff members is identified at my building.	1 2 3 4 NA DK
2. My building principal is an informed member of the building leadership team.	1 2 3 4 NA DK
3. All leadership team members participated in a curriculum mapping training.	1 2 3 4 NA DK
4. The leadership team has been trained by a qualified curriculum mapping trainer (Dr. Susan Udelhofen, ESA	1 2 3 4 NA DK

curriculum leader, Curriculum Mapping Software Representative)	
5. The leadership team has a clear picture of the curriculum mapping initiative.	1 2 3 4 NA DK
6. The curriculum mapping leadership team has a clear understanding of their role in the curriculum mapping process.	1 2 3 4 NA DK
7. The leadership team has a plan for continued curriculum mapping professional development and updates.	1 2 3 4 NA DK
7. The leadership team has established a clearly articulated long-term plan beyond the initial implementation stage (initial cycle) of curriculum mapping.	1 2 3 4 NA DK
8. The leadership team is trained to confidently use the curriculum mapping software program.	1 2 3 4 NA DK
9. My building administrator has created a staff development map that includes goals (content) , objectives (skills), and evaluation (assessment).	1 2 3 4 NA DK
10. My building administrator has shared his/her staff development map with the staff.	1 2 3 4 NA DK
11. My building administrator is trained to use the curriculum mapping software program.	1 2 3 4 NA DK

SECTION IV. CURRICULUM MAPPING NEXT STEPS	1= Strongly Agree 2= Agree 3= Disagree 4= Strongly Disagree NA= Not Applicable DK = Don't Know
1. Analyzing the curriculum mapping data provides the basis for making curricular and professional development decisions.	1 2 3 4 NA DK
2. Curriculum mapping will continue without State funding.	1 2 3 4 NA DK
3. Curriculum mapping has long term positive effects on instructional design and delivery.	1 2 3 4 NA DK
4. I had formal training to design essential questions.	1 2 3 4 NA DK
5. I have included essential questions on my maps.	1 2 3 4 NA DK
6. I have had adequate consensus/core map training.	1 2 3 4 NA DK
7. The teachers at my building have created consensus/core maps.	1 2 3 4 NA DK
8. My curriculum maps are aligned to the South Dakota Student Academic Standards.	1 2 3 4 NA DK
9. I understand how to use the mapping data in tandem	1 2 3 4 NA DK

with standardized test data results.	
10. I have a good understanding of how to sustain curriculum mapping beyond the initial cycle.	1 2 3 4 NA DK
11. A well articulated plan is in place for continual updating and discussing curriculum maps.	1 2 3 4 NA DK
12. I have a good understanding of the long term benefits of curriculum mapping.	1 2 3 4 NA DK
13. I have a good understanding of how to continually use my curriculum maps to inform my teaching.	1 2 3 4 NA DK
14. My colleagues at my building have a good understanding of how to continually use curriculum maps to inform teaching instruction.	1 2 3 4 NA DK

SECTION V. CURRICULUM MAPPING SOFTWARE	1= Strongly Agree 2= Agree 3= Disagree 4= Strongly Disagree NA= Not Applicable DK = Don't Know
GENERAL SOFTWARE STATEMENTS (Complete only if you are using a software program ***other*** than TechPaths	
1. I was adequately trained to use the curriculum mapping software program to enter the curriculum mapping data.	1 2 3 4 NA DK
2. I feel confident using the curriculum mapping software program.	1 2 3 4 NA DK
3. I know how to use the search function of the curriculum mapping software program.	1 2 3 4 NA DK
4. I have used the search function of the curriculum mapping software program to analyze curriculum mapping data.	1 2 3 4 NA DK
5. I know how to use the reports function of the curriculum mapping software program.	1 2 3 4 NA DK
6. I have used the reports function of the curriculum mapping software program to analyze curriculum mapping data.	1 2 3 4 NA DK
7. Curriculum maps and curriculum mapping reports generated using the curriculum mapping software program allows for more efficient comparison and analysis of mapping data.	1 2 3 4 NA DK
8. The curriculum mapping software program personnel were responsive and helpful with my software problems and/or questions.	1 2 3 4 NA DK

9. The curriculum mapping software program has helped me more effectively develop and use curriculum maps.	1 2 3 4 NA DK
TECHPATHS SPECIFIC STATEMENTS (Please complete ***only*** if you use TechPaths)	
1. I was adequately trained to use the TechPaths software program to enter my curriculum mapping data	1 2 3 4 NA DK
2. I feel confident using the TechPaths software program.	1 2 3 4 NA DK
3. I know how to use the search function of the TechPaths software program	1 2 3 4 NA DK
4. I have used the search function of TechPaths to analyze curriculum mapping data.	1 2 3 4 NA DK
5. I know how to use the reports function of TechPaths	1 2 3 4 NA DK
6. I have used the reports function of TechPaths to analyze mapping data.	1 2 3 4 NA DK
7. Curriculum maps and curriculum mapping reports generated using TechPaths allows for more efficient comparison and analysis of mapping data.	1 2 3 4 NA DK
8. The TechPaths personnel were responsive and helpful with my software problems and/or questions.	1 2 3 4 NA DK
9. I participated in an on-site TechPaths training session.	1 2 3 4 NA DK
10. I participated in a TechPaths training session provided through a conference call.	1 2 3 4 NA DK
11. TechPaths has helped me more effectively develop and use curriculum maps.	1 2 3 4 NA DK

Part III: Comments

Please use the following space to record any comments regarding the preceding survey sections. (Note: spaces for recording comments are eliminated in this version .)
SECTION I: CURRICULUM MAPPING PRELIMINARY PREPARATION
SECTION II: CURRICULUM MAPPING IMPLEMENTATION
SECTION III: CURRICULUM MAPPING LEADERSHIP
SECTION IV. CURRICULUM MAPPING NEXT STEPS
SECTION V. CURRICULUM MAPPING SOFTWARE PROGRAMS

APPENDIX D

Survey Items Analyzed to Inform Research Question One

1.19 A curriculum mapping software program is in place to facilitate the mapping process.

2.15 I used the Reports feature of the curriculum mapping software program to assist with the curriculum mapping review process.

2.22 The curriculum mapping software tool helped me and my colleagues to communicate and collaborate more effectively about our maps.

4.8 My curriculum maps are aligned to the northwestern state Student Academic Standards.

5.T.1 I was adequately trained to use the TechPaths software program to enter my curriculum mapping data.

5.T.2 I feel confident using the TechPaths software program.

5.T.3 I know how to use the search function of the TechPaths software program.

5.T.4 I have used the search function of TechPaths to analyze curriculum mapping data.

5.T.5 I know how to use the reports function of TechPaths.

5.T.6 I have used the reports function of TechPaths to analyze mapping data.

5.T.7 Curriculum maps and curriculum mapping reports generated using TechPaths allows for more efficient comparison and analysis of mapping data.

5.T.9 I participated in an on-site TechPaths training session.

5.T.11 TechPaths has helped me more effectively develop and use curriculum maps.

APPENDIX E

Survey Items Analyzed to Inform Research Question Two

1.2 I attended a curriculum mapping introductory meeting that clearly described the curriculum mapping process before I attended a formal curriculum mapping training.

1.3 The curriculum mapping process (which includes creating a map, reviewing maps, participating in small and large group sharing and developing an action plan) was effectively introduced before I got started.

1.4 I had a clear understanding of the curriculum mapping process before I created a curriculum map.

1.6 I believe that curriculum mapping can improve education in a northwestern state.

1.8 Curriculum mapping will benefit the teaching practice of the teachers at my building.

1.14 A specific timeline was established and communicated before curriculum mapping was to begin.

1.15 The curriculum mapping initiative is clearly identified in the district's school improvement plan.

1.16 District policies and procedures have been reviewed to ensure they support and do not hinder the curriculum mapping work/processes.

2.1 I independently completed an individual curriculum map that includes content, skills and assessments.

2.3 I independently completed a curriculum map that includes content, skills and assessments for every class I teach.

2.6 I had adequate time to complete my individual maps.

2.7 I reviewed groups of my colleagues' maps at my grade level within my building.

2.8 I reviewed groups of my colleagues' maps beyond my grade level.

2.9 I reviewed groups of maps from those outside my building.

2.10 I had adequate preparation and guidance to review other teachers' maps.

2.12 I met with small groups of colleagues to discuss map reviews.

2.13 I had adequate time to meet with my colleagues to share map reviews in small groups.

2.14 I had guidelines to follow when meeting with my colleagues to share map reviews in small groups.

2.19 All steps of the initial cycle (creating an individual map, reviewing colleagues' maps, sharing reviews, creating an action plan) of curriculum mapping were implemented as proposed.

4.1 Analyzing the curriculum mapping data provides the basis for making curricular and professional development decisions.

4.3 Curriculum mapping has long term positive effects on instructional design and delivery.

4.8 My curriculum maps are aligned to the northwestern state Student Academic Standards.

4.12 I have a good understanding of the long term benefits of curriculum mapping.