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Investigating the Transition Process When Moving From a Spiral Curriculum Alignment Into a Field-Focus Science Curriculum Alignment in Middle School

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Dr. Sherrie Wisdom, Committee Member	3-4-11 Date
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Declaration of Originality

I do hereby declare and attest to the fact that this is an original study based solely upon my own scholarly work here at Lindenwood University and that I have not submitted it for any other college or university course or degree here or elsewhere.

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Abstract

This investigation examined the transition from a spiral science curriculum to a field-focus science curriculum in middle school. A spiral science curriculum focuses on a small part of each field of science during each middle school year, more of a general science concept. In contast to that, the base of a field-focus curriculum is that each grade level focuses on a specific field of science, more of a high school like concept. The literature reviewed provides a history of science education, the steps of the change process, and the importance of professional development. The literature review provided a basis for determining trends in the science education.

The researcher collected a variety of data to understand the process that districts move through to transition to a field-focus science curriculum. Interviews provided information concerning the transition process of three Midwestern school districts that have arranged their curriculum into a field-focus alignment. Teacher surveys of one district supplied the perceptions of the professional development involved during the transition process. The researcher also examined school district student achievement data in the area of science.

Suggestions made through this investigation focused on the Eight Steps to a Successful Change when implementing a field-focus science curriculum alignment. Following the suggested steps will help a transition go smoother.

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Chapter One: Overview of Study

Currently, the mind frame of educators is on data-driven instruction. Any new program or procedure implemented in a school must have data to demonstrate that it will lead to improvements. Schools collect data to determine weaknesses in successful delivery of academic content and to examine ways to improve the weaknesses through application of research-based best practices. If data is not present to support the information, then the idea brought forth is just an opinion (Reeves, 2002).

Since the implementation of No Child Left Behind (NCLB) in 2001, which states that all students must be proficient on state assessments by 2014 (Department of Elementary and Secondary Education, 2010), the focus of most school leaders has remained on the outcome of standardized test scores. If student scores are not meeting state standards, then a change is necessary. Expectations are that struggling schools will show improvement that leads toward meeting the required Adequate Yearly Progress (AYP) put into effect with the adoption of NCLB. As a teacher in a struggling school district, I am constantly examining data to drive decisions that will improve the school. For example, when I give a test, I analyze the data from the test (the number of students who are proficient compared to those not proficient) and determine how to move forward with my instruction. "Tests can act as learning tools before, during, and after test administration" (Smith, 2009, p. 28). I look at which students need remediation and provide more focused individualized instruction to help them become proficient. The district and school's proficiency level is determined utilizing the outcome of state standardized test scores, the Missouri Assessment Program (MAP) test. The state sets

guidelines that determine proficiency level on the MAP test, and when a student meets the proficiency level, he or she is determined to perform at grade level.

At the middle school level, the MAP test measures school proficiency for the sixth, seventh, and eighth grade communication arts and mathematics, as well as the eighth grade science (Department of Elementary and Secondary Education, 2010). The state sets brackets for the scores and determines the percentage of students that are proficient or advanced for the school. The eighth grade science MAP test covers, all content throughout middle school, designated by the Missouri grade level expectations (GLE) (Department of Elementary and Secondary Education, 2010). Thus, middle school teachers must implement a science curriculum that supports students in retaining information covered over a three-year span.

The need for aligned science curriculum is not only necessary because of standardized testing. "As we progress through the twenty-first century, we can no longer afford to lag behind in our teaching of science content in schools across the country" (Berube, 2008, p. 226). Teachers and school leaders must investigate all aspects of the curriculum to determine the most effective way for students to learn the information. Teachers examine different teaching strategies that allow for greater explanation of the curriculum, leading to a deeper understanding. While school leaders, on the other hand, might compare scores of different teachers to determine if a teacher is strong in one area or needs professional development in another. Curriculum alignment must also be investigated to ensure the most effective delivery for student learning. No matter how effective the instruction is, if the content is not vertically aligned with the other grade levels, the instruction was in vain.

The school where I teach implemented a new curriculum alignment in response to low achievement on science standardized test scores. The school district's science coordinator theorized that students could gain more knowledge of science if the delivery of the content was in a field-focus science curriculum alignment, instead of the previous method based on spiral curriculum alignment. A field-focus science curriculum alignment concentrates on a specific field of science for the entire school year. For example, sixth grade could focus on ecology, while seventh grade focused on physical science, followed by eighth grade focusing on Earth science. In a spiral curriculum alignment, a small piece of each field of science is taught each year, similar to a general science class. An example is where sixth grade would cover part of Earth History, while seventh grade would focus on Earth and Space, leaving eighth grade to cover weather systems on Earth. All these topics build on each other, but the coverage of the information takes place throughout the middle school years.

The belief of our district coordinator was that a field-focus curriculum alignment allows teachers to go more in depth on science topics, because the step of covering prior knowledge is eliminated, since the teacher already knows what the students learned in that field of science. Allowing teachers to delve deeper into the field of science theoretically allowed students to gain more instruction on specific concepts leading to retention of more information, thus theoretically leading to higher scores on the eighth grade MAP test.

Background of the Researcher

I am investigating the transition to a field-focus science curriculum motivated by my many experiences of change in the science curriculum in the "New Heart" school

district. In the spring of 2003, I graduated from college and fortunately was hired as an eighth grade science teacher in the New Heart school district. When I first walked into my classroom in the fall of 2003, the science curriculum was in disarray. I was told the middle school grade level expectations posted on the Missouri Department of Elementary and Secondary Education (DESE) website were my curriculum guide. In addition, many others in the science department did not recommend using the district provided science book, due to its lack of good, thorough content. To say the least, I was overwhelmed, but as a new teacher, I was ready for anything; I was just ecstatic to have a job and a classroom I could call my own. I sat with the grade level expectations in front of me, trying to decipher what exactly they all meant. I was to figure out the best way to teach all of the grade level expectations (GLEs), but I did not know the best way to break down the GLEs. An example of a GLE follows:

> Strand 1:1:C:a- Describe evidence (e.g., diffusion of colored material into clear material such as water; light reflecting off of dust particles in air; changes in physical properties and reactivity such as gold hammered into foil, oil spreading on the surface of water, decay of organic matter, condensation of water vapor by increased pressure) that supports the theory that matter is composed of moving particles too small to be seen (atoms, molecules) (Department of Elementary and Secondary Education, 2010, 1:1:C:a).

I felt that my lack of understanding was partially due to lack of familiarity with the GLEs from my undergraduate classes, as well as a lack of additional curriculum in place in the New Heart School District to align with the GLEs. I was unsure how to implement the GLEs in my lesson planning.

About a month into my first year of teaching, the state released the standardized assessment scores for the New Heart School District from the previous year. Results for all areas tested were weak, but science was extremely weak; the worst of all of the scores. This was consistent with scores from the previous years. Again, I did not receive much guidance on what to do or how to use the data from the scores to guide my instruction. All I knew was that I needed to make sure I covered as much information as I could to help students score better on future assessments. I worked hard to plan lessons that I thought would cover the necessary information, but since it was recommended that I not use the available science textbooks, the basis for all planning was from the internet and curriculum purchased from a local education store. I was not alone; each science teacher was covering as much information as possible, but grade level alignment was not occurring. Collaboration on lessons within the grade level and across grade levels was non-existent. The science teachers, for the most part, covered the topics they found to be most comfortable. For example, I enjoyed teaching about the solar system, and attempted to cover as many GLEs as possible throughout the year. With a school of 1400 students, there were 12 science teachers, each marching to the beat of their own drum. This led to overlap of curriculum from year to year, as teachers were not sure what the previous grade level teachers covered.

Then in the spring of 2007, the district science coordinator asked me if I would pilot the use of a kit to use in my science class. The kit provided very detailed lessons that built on one another. The kit had specific objectives for each lesson, which were similar to of the GLEs. For the first time in four years, I felt like I had some guidance concerning what and how to teach. The opportunity gave me a sense of excitement,

because I had been told by the coordinator and trainer for the kits, that the design of the kits was based on data from other schools' implementation of the included activities. Each kit focused on a strand of the grade level expectations. If the implementation of the kit were thorough, then coverage of nearly all grade level expectations under the specific strand would occur in a systematic fashion. After piloting the use of multiple kits in different grade levels, the district adopted them for use in the district middle school science classrooms, assigning each grade level to three specific kits. The textbooks were eliminated from the classrooms and the kits (which have inquiry text books provided) replaced the previous curriculum materials. The science curriculum alignment at the start of the implementation of the kits from 2007-2009 is displayed in Table 1.

Table 1

Alignment of Science Curriculum from 2007-2009

Grade	1st Kit	2nd Kit	3rd Kit
6	Population and Ecosystems*(a)*	Chemical Interactions*(b)*	Earth History*(c)*
7	Earth in Space*(c)*	Energy, Machines, and Motion*(b)*	Catastrophic Events**(c)*
8	Catastrophic Events**(c)*	Earth History*(c)*	Macro to Micro*(a)*

Note: The letters after the number depict the field of science where the topic falls.
a: Life Science, *b*: Physical Science, *c*: Earth Science
*The Catastrophic Events kit is the same kit, the grade levels each taught a portion of the kit.

Table 1 represents a spiral curriculum, where instruction from a unit of each field takes place each school year, with all units covered by the time students would be taking the state science assessment at the end of the eighth grade year. Appendix A show a representation of the grade level expectations for a spiral curriculum alignment.

During the summer of 2009, the district hired a new science curriculum coordinator. At the beginning of the school year in the fall of 2009, the science

coordinator approached the teachers with a new idea of arranging the use of the kits to align by fields of study instead of the current spiral sequencing of topics. She explained that other school districts were seeing gains in their science state assessment scores when they aligned their curriculum so that each grade level would focus on a specific field of science, which I refer to as a field-focus curriculum. When a field focus curriculum is in place, the concepts build on each other, allowing students to build on prior knowledge, generally leading to deeper teaching due to eliminating re-teaching of lessons (Olson J. , 2008). For example, concepts in Earth science build on each other. If a teacher has covered the layers of rocks, then when teaching of earthquakes occurs later, the teacher does not have to go as in depth on the different rock layers. Instead, the teacher can briefly revisit information and then move deeper into information on earthquakes. The original idea was to follow a slow process; the transition would start with the sixth grade and by the end of three years, all grade levels would align. Middle school science teachers agreed with this plan, and were willing to make all the necessary changes to make it happen. Table 2 displays the new kit topic alignment.

Table 2

Alignment of Science Curriculum 2009-present

Grade	1st Kit	2nd Kit	3rd Kit
6	Aquatics-Ecosystems*(a)*	Macro to Micro*(a)*	Population and Ecosystems*(a)*
7	Properties of Matter*(b)*	Energy, Machine, and Motion*(b)*	Light and Sound**(b)*
8	Catastrophic Events*(c)*	Earth History*(c)*	Earth in Space*(c)*

Note: The letters after the number depict which field of science.
a: Life Science, *b*: Physical Science, *c*: Earth Science
*Light and sound was not covered previously, but were added in due to coverage in DESE grade level expectations.

Many changes have taken place in my school district since I started teaching there in the fall of 2003. The district has made great strides in giving teachers guidance in best educating our students. The new coordinator has brought about a new vision to help guide us toward building on science concepts taught to the students to gain a stronger in-depth understanding, and by aligning the curriculum, so that the focus is on a specific field each year. Appendices B represent the grade level expectations adapted for a field-focus science curriculum. However, our district and others like ours have little research to draw on when making this transition.

In a data-driven educational society, change is inevitable in schools. Districts are always looking for the newest and best ways to deliver instruction to the students, so that students become productive members of society. With 21st century skills, such as collaboration and integration of hands-on technology, how students learn is extremely important (Harris-Helm, Turckes, & Hinton, 2010). Science education is ever changing as new ideas and concepts, as well as an increase in the availability of technology, surface. There are skills that are required in science, such as observation and generating and testing hypotheses, that other subject areas do not have the need to cover, so these skills must be prominent in science classrooms (Berube, 2008). Science educators are moving toward covering concepts of science instead of topics (Olson, 2008). The coverage of science concepts increases the understanding of students' skills, and in turn should lead to a raise in standardized test scores. The concepts travel over several topics in the same field of sciences, and if students understand the underlying concepts then they are able to apply the knowledge to each topic in the specific science field when it is covered (Olson., 2009). Changing science education to meet the needs of the 21st

century is necessary to provide students with the knowledge and skills to function in society.

Statement of Problem

Schools go through changes in procedures and practices each year and change can be a difficult aspect for a number of stakeholders. In general, change is an uneasy process, taking stakeholders out of their comfort zone. Knowing which steps to take and how to make the transition process easier can lead to a smoother transition (Kotter, 1996). Making sure all stakeholders have the necessary support helps to make change easier (Williamson & Blackburn, 2010). If all the necessary support systems are in place, then no one will fall through the cracks during a change process. The success of an innovation will come if all the necessary support systems and steps are in place.

It is necessary for the leader of an innovation to understand how to negotiate the change process. The leader should share the vision with affected stakeholders during the innovation implementation (Cummings, 1999). Striving for the same goal helps to focus the implementation of objectives around a common focus. Development of the common vision progresses the change process. The leader must work from the vision to help to support all the stakeholders, so that everyone involved can see the effects of the innovation.

Purpose of Study

The purpose of this qualitative study is to investigate the transition process of moving from a spiral science curriculum alignment to a field-focus science curriculum alignment in my school district. The state of Missouri requires the public school districts to assess eighth grade students on the mandated grade level expectations as outlined by

the Department of Elementary and Secondary Education. I investigated the process that my district went through to implement the transition to a field-focus science curriculum alignment, as well as the challenges that the district encountered during the transition process. As a teacher, I experienced this transition process; I also interviewed district coordinators, other than my own, who have made the transition process, as well as the educational consultant of science for the Department of Elementary and Secondary Education to gain insight. This study may provide suggestions for any public school administrators, curriculum directors, and science coordinators who are considering this or a similar transition.

The demographics of the New Heart School district are approximately a 70-30 split between black students and white students, with a small percentage falling in the other categories of ethnicity. The district's free and reduced lunch count has risen to over 50% of the population qualifying, based on family income.

Research Questions

Question 1: What process did my district, and surrounding districts utilize when making a transition to a new curriculum alignment in middle school science?

Question 2: What challenges face my district and surrounding districts when making the transition to a new science curriculum alignment?

Question 3: How do teachers perceive the transition process, specifically the related professional development in my district?

Question 4: What recommendation of strategies for middle school science does the state of Missouri give?

Question 5: How do the curriculum materials and teacher resources support the grade level expectations mandated by the Department of Elementary and Secondary Education?

Definition of Terms

Field-Focus Curriculum: A field-focus science curriculum is one that teaches related concepts throughout the year that all fall within a specific science topic. There is not much literature that has focused on this type of alignment, so the definition is one developed by the researcher. This alignment is set up much like the traditional high school, where students take physics, biology, and chemistry.

Grade Level Expectations: Grade-level expectations provide a framework of information to cover at each grade-level (Department of Elementary and Secondary Education, 2010).

Missouri Assessment Program (MAP): The MAP is a statewide assessment that determines the students' progress towards the educational standards set by the state of Missouri (Department of Elementary and Secondary Education, 2010).

No Child Left Behind: A bill passed by President Bush in 2001 assuring all students would receive a high quality education (U.S. Department of Education, 2009).

Spiral-Curriculum: A spiral-curriculum alignment is one that is set up so that coverage of course topics are small and covered in repetition each year. This set up is more of a general science alignment, similar the alignment of elementary subjects (Caldwell, 2008).

Limitations

A key limitation to this study is the analysis of the process of other schools that have made the transition from a spiral curriculum to a field focus curriculum. It is necessary for me to understand what other schools did when they made a transition. To better understand the transition process made by other districts, I interviewed personnel to gain background knowledge about their processes. The limiting factor is that I was not involved in working with the specific districts, so understanding of the processes will have to be formed from responses to interview questions given by the science coordinators or acting administrators supervising science in those districts. Thus, this data is self-reported rather than gathered through experience or observation.

A second limitation is the number of school districts accessed for the study was limited due to participation in the type of alignment of science curriculum in the middle school. Participating schools must have their curriculum aligned to focus on specific fields of science each year, instead of the previous method of spiraling. I will limit the

study to school districts in the St. Louis area that have a field-focus alignment of the curriculum in the middle school level.

The quantity of data will be limited to the number of years that districts have arranged their science curriculum with alignment toward field-focus instead of spiraling. A district cannot tabulate a growth in MAP scores until the field-focus curriculum alignment has been in place for a three-year period, because the full implementation of a field-focus alignment takes three years to complete. The first set of data points to compare is that of the students entering the sixth grade at the start of the transition process. When these students reach the eighth grade MAP test, having experienced a field-focus curriculum alignment, students will have learned all the grade level expectations in their middle school years. The amount of quantitative data actually gathered will vary from district to district, depending upon the individual districts' current curriculum alignment methods and any recent changes in curriculum alignment. Districts will not be able to see the full outcome of the new alignment of curriculum and the subsequent effects on the MAP scores until three years into the new curriculum arrangement, when the 2009-2010 sixth grade students will be completing the eighth grade MAP test in 2012. For this study, I am focusing primarily on the transition process and the perceptions of teachers through the transition process, rather than statistically significant increases in student achievement measured by the students' standardized assessment scores.

Various factors determine the outcome of student MAP scores. The supplies that the teachers utilize in the classrooms are determined by the individual districts. The curriculum coordinators throughout the district determine the textbooks that are used. Lab supplies can vary as well, depending on the district. The pace provides a guideline

and the extent to which the districts follow them are all factors that can play into the outcome of the eighth grade science students' MAP scores. Each teacher's style is different although all are teaching information to support the same GLEs.

Lastly, a limitation in my study is that I am a teacher in the district that is experiencing the process. However, my lived experience of the transition process will also provide data. I have triangulated data from multiple sources to overcome this limitation as much as possible.

Conclusion

Staying current with the newest methods of teaching science is essential in the 21st century. New ideas in science and technology are evolving every day. If the educational society does not stay focused on the best practices for teaching science, then the United States has the possibility of losing ground as one of the leaders of science (Lynn, 2008). With data supporting the need for change, it is important to make the transition from a spiral-science curriculum to a field-focus science curriculum as smooth as possible. I will evaluate the process of change to a field-focus science curriculum in the New Heart School District. The evaluation will provide information that may allow other districts considering the same type of change to determine what steps are necessary to take to make the transition smooth. The next chapter will review the literature relating to the study regarding, the history of science education, concept-focused teaching, the process of change, and professional development for the 21st century.

Chapter Two: Literature Review

This literature review begins with the history of science education. Science education has changed greatly over the years, due to scientific advances. Following the history of science education is literature on the process of change. Change can be difficult, but understanding the process of change can allow for a smoother transition. Lastly, the literature review comprises information regarding professional development. In educational settings, strong professional development will help create a better implementation of the new instructional methods. It is also important for professional development to support teachers in the execution of necessary skills to raise the student assessment scores, which evaluates the district's success.

History of Science Education

Prior to World War II science was generally taught exclusively through the topics of science, for example: solar system, plants, animals, etc. Teachers would focus on single topics at a time and not discuss how the topics intertwine with each other. In the 1920s, science instruction focused on wide, unifying subjects that applied to daily life and would culminate with large projects (Colburn, 2009). Colburn's study argued that student interest drove science education in this time period. (See figure 1 for a timeline.)

World War II brought in a new focus in science education due to the increased use of technology during the war. With the enhancement of new technology, an education needed to emphasize more science and engineering (Colburn, 2009). With the end of World War II, the United States leaders in education realized the importance of scientific inventions that helped the nation to win World War II. The drive to expand the

effort of United States to develop inventions and advanced technology changed the focus from scientific topics to incorporating the scientific method into science instruction.

If the United States did not alter its vision, it would be at an enormous disadvantage and there would be a possibility of defeat in another world war (Oliver, 2001). New technology and inventions used throughout the war caused educators to reconsider their teaching methods. Educators focused on what is the unknown in the lab, and allowed the students to discover for themselves the importance of scientific inquiry. This is how real scientists work, so it seemed appropriate to structure science classes in the format of inquiry. When postwar teaching began, David Aptekar stated the following when writing an article for the *School Science and Mathematics* magazine in 1945:

> "Now that everybody is concerned with postwar planning we naturally turn our attention to the challenge of doing a better job of teaching science. Critical reflective analysis of our courses indicates that many of us are victims of the 'traditional approach' to the teaching of the exact sciences." (Aptekar, 1945, p. 33)

Teachers needed to look more into discovery of new science information, instead of just teaching what had already been proven in the science world.

Science education became even more important when in 1957 the Soviet Union launched the first successful manned space craft, known as *Sputnik* (Lynn, 2008). This caught the Americans off guard, as they did not expect it to happen as quickly as it did. The event caused an immediate reaction from scientists and politicians in the United States, and led to the development of the National Science Foundation (NSF) (Duschl, 2008).

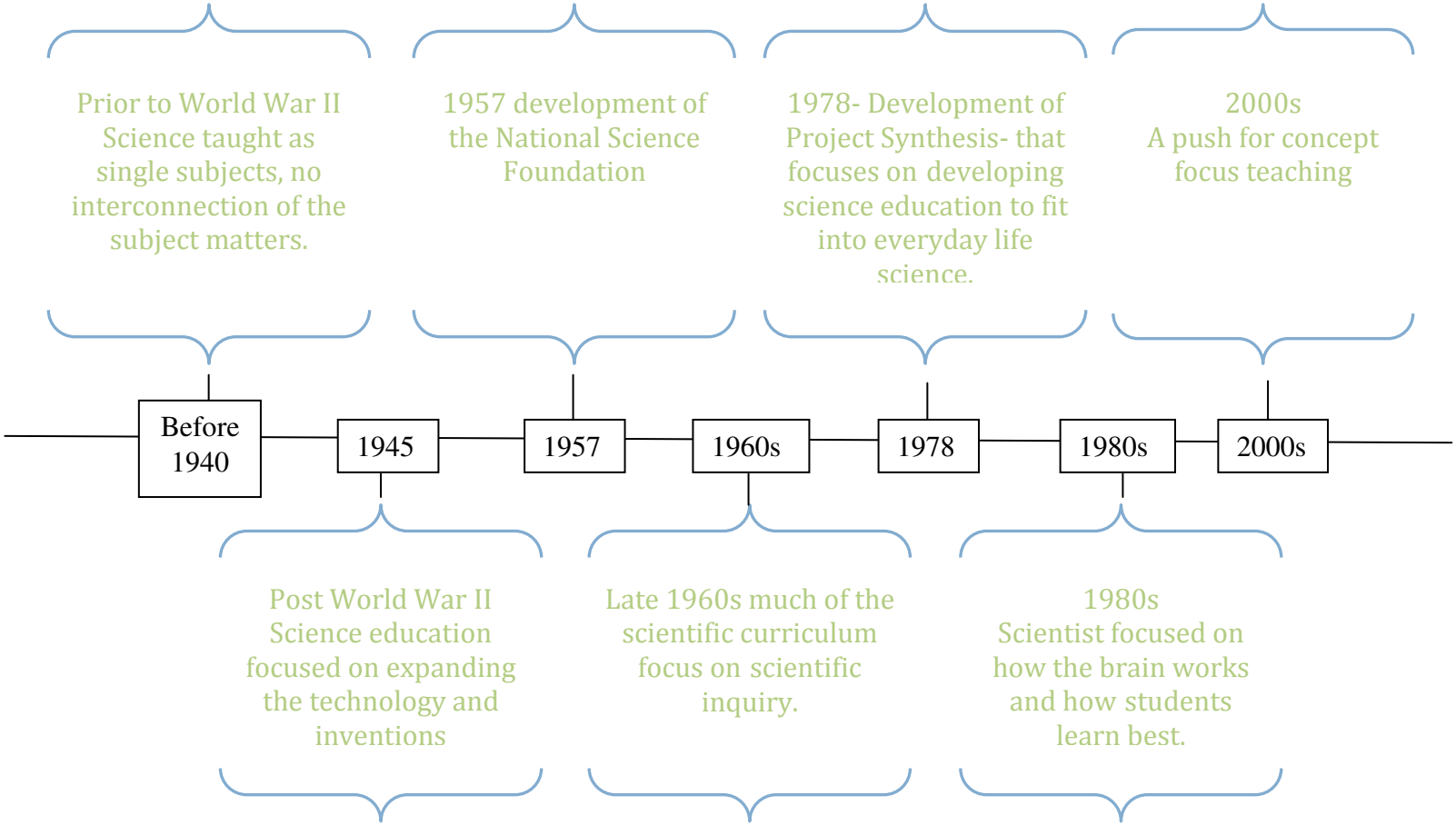

***Figure 1*: Timeline of Science Education**

The United States started the NSF to upgrade the science studies that were occurring in school settings. With an enhancement in science education the United States would be able to compete with other countries; otherwise there was a fear of losing power in the military, which could lead to defeat in another world war.

In 1947, Gordon Mork reasoned that the placement of the scientific method instruction moved into the science classroom (Oliver, 2001). The scientific method is a "set of processes that involve logical reasoning about evidence, theory change, and participation in the culture of scientific practices" (Duschl, 2008, p. 47). The release of *Sputnik* amplified the focus upon science in the school settings, leading to a significant increase in spending on scientific research and education (Lynn, 2008). By the late 1960s, around 30 K-12 curriculum projects sponsored by the NSF and the majority of science instruction occurring in schools moved toward inquiry-based instruction (Duschl, 2008). The inclusion of the scientific method into science instruction allowed for students to explore through a hands-on approach.

Science teachers, and the educational leaders who set scientific standards, realized the importance of using the scientific method in the classroom. This led to a greater drive toward science inquiry lessons. In the 1960s, teachers did use science inquiry, but it was mainly led through textbook instruction. Use of textbooks was a way of guiding what teachers taught and included the teaching approaches that would ensure success (Yager, 2000). Unfortunately as most things fade away, so did the reform of science education. By the mid-1970s, the political leaders of Washington envisioned that there needed to be a change in science education for the nation to continue to be one of the leaders in the world of technology, discoveries, and inventions. However, before a decision on a new

reform was made, the politicians believed that education activists should conduct further study and research (Yager, 2000).

In 1978, a study called Project Synthesis developed four major goals for science education:

1. Personal Needs. Science education should prepare individuals to utilize science for improving their own lives and for coping with an increasingly technological world.
2. Societal Issues. Science education should produce informed citizens prepared to deal responsibly with science-related societal issues.
3. Career Awareness. Science education should give all students an awareness of the nature and scope of a wide variety of science and technology-related careers open to students of varying aptitudes and interests.
4. Academic Preparation. Science education should allow students who are likely to pursue science academically as well as professionally to acquire the academic knowledge for their needs (Harms, 1977, p. 4).

In a later wrap up of Project Synthesis, Harms and Yager stated that there is a need to know how science plays a role in everyday life (1981). The question was posed:

> Can we shift our goals, programs, and practices from the current overwhelming emphasis on academic preparation for science careers for a few students to an emphasis on preparing all students to grapple successfully with science and technology in their own, everyday lives, as well as to participate knowledgeably

> in the important science-related decisions our country will have to make in the future? (Harms and Yager, 1981, p. 119).

The research developed by Project Synthesis changed the views of science to mold the instruction to advance the whole class of students' learning, by focusing on the use of the material taught in everyday life events. An example is applying Newton's Laws of Motion to a sport the student plays. Having the students relate the subject to an interest helps them to retain the knowledge. It would be more relatable for all the students; a change from the direct focus on science careers, which only affected a handful of the students.

Education is such a broad setting that change can be difficult. With the number of educators in the United States school system, when there is a need for change transformation takes time. The reformation that Harms and Yager discuss in the wrap up of Project Synthesis is a necessary one, because it recommended a science curriculum that would help all students. Before the 1970s, during the push for scientific inquiry, science education was so focused on the development of true scientist that it often lost the interest of those not pursuing the science field as a career. In the Project Synthesis proposal, the scientific inquiry piece was still included, but in the context of students' everyday lives.

How the Middle School Brain Works

In the early 1980s, there was instability in the economy of the United States, which led the educational systems that were in place to seem inferior to the other leading countries of the world, such as Japan and Germany. The United States needed to develop a new approach to stay in the lead in science education. It was determined that teachers

need to understand how students learn to best teach them. In all students, teachers can see the difference in physical maturity, but teachers cannot see the difference in mental maturity (Vawter, 2010). With this in mind, teachers were teaching to the ability of the students' physical maturity, instead of knowing the level of mental maturity. The National Science Foundation did not think it was time for yet another reform, but instead took a different approach and made funds available to study how humans learn, which in turn focused educational researchers on cognitive science (Yager, 2000). They wanted to know how information is stored in the memory. "Memory is a glorious and admirable gift of nature by which we recall past things, we embrace present things, and we contemplate future things through their similarity to past things" (Fahey & de los Santos, 2002, p. 380). Although the definition of memory provided is accurate, scientists actually wanted to understand how information stays in the memory. Understanding how the brain works would allow educators to help develop curriculum and instruction in a way that would lead to better retention of information.

Prior to knowing the best approach to teaching, it was necessary to understand how a human's brain works to store information into memory. When a student takes in information taught in class, the brain goes through a three step storing process. The first of the steps is the sensory input. This is when a stimulus produces an action after exposure of information to one of the five senses (Nunley, 2003). The information collected is through the five senses but moves past the entry sense into the brain (Ford, 1996). Then the information will move on into short-term memory. Short-term memory only lasts about 20 seconds and the information then leaves. The information can leave the mind for good or moves onto the last step of the memory path, the long-term memory.

This step in the memory process is the step used by students to place items they want to remember for an extended period. Once the information is in the long-term memory, students place it into a category. They give it a label, for example, "something I learned in science," and then place the item retained into a category containing other items learned in science. Students take the information they learn and store it in "file folders" in their brain (Kissner, 2009). When information is stored into the long-term memory, the students cross-reference the information with information they already know and can relate to the concept. Being able to cross-reference the information leads students to learning the information (Nunley, 2003). They take the information, file it into the brains and link it to previously learned concepts.

There are two types of learning: explicit learning and implicit learning. According to the book, *Teaching with the Brain in Mind*, by Eric Jensen (2008), explicit learning includes items ones reads, writes, and discusses. This type of learning is generally, what is witnessed in classrooms. The explicit learning includes studies completed in class on a daily basis. When students read texts to learn new concepts, write about what they have read, or discuss what they are reading, it is explicit learning. The second type of learning, implicit learning, consists of things a person learns through life experiences, habits, games, and experiments (Jensen, 2008). This is the type of learning utilized when students experience hands-on experiments and projects. For example, when a student heats up a chemical to observe what happens and stores that observed information to memory. Students are actually producing and performing the action, which leads to implicit learning.

Once a person learns information and processes it through the memory, it moves into one of the three-memory storage systems in the brain. The first system is procedural memory, the place where the every day process occurs. An individual does not consciously think about the procedural memory, it is built into the brain and the task is done, sometimes without the person realizing he or she is completing the task. An example of procedural memory is the process of breathing; an individual does not think about breathing, it just occurs. People complete specific procedures so often that they simply becomes customary. In a classroom, sitting a specific seat can become part of a person's procedural memory. The student completed the procedure daily, and it became part of the routine.

The second storage system is episodic memory, this where the individual stores information learned through the hands-on approach, or implicit learning (Nunley, 2003). For example, a student is performing a lab where sulfur is heated. Sulfur lets off a smell that the students do not forget. The result of what happened, the stinky smell, becomes part of the episodic memory.

Lastly, is the semantic memory storage area. This is the area of the brain where information is stored when it is intentionally learned, or the explicitly learned (Nunley, 2003). The semantic memory would include storing items that a student learned in science categorized by soluble and insoluble substances when mixed with water. The students might have made a table to categorize the substances that were soluble and insoluble and have stored the information in their semantic memory.

As students are exposed new information, they move it into the memory and attach the information to items previously stored in the memory. This type of

categorization is a schema. Schemas develop over time, with new ideas and beliefs added as the person encounters more experiences with a concept (Kissner, 2009). The schemas continue to grow each time a new concept is learned. The most important objective of the brain in the process of retaining information to become crystallized memory, to be stored for an extended period of time, is to cross-reference the information (Nunley, 2003). Cross-referencing puts the information into categories based on prior knowledge. Prior knowledge gives students a base of information from which to start (Jensen, 2008). An example of cross-referencing is if the teacher explains that the nucleus of the cell is like the brain of the human body. A student might know that the brain controls everything the body does, so the conclusion is that the nucleus must control everything a cell does.

Understanding the steps to storing information to memory is important, as it leads teachers to an instructional approach that helps students to better retain information. Determining the different types of learning, explicit and implicit, allows teachers to focus on how learning takes place in the classroom structure. When a teacher is aware of the three-memory storage areas, the designing of lessons can focus on necessary information to retain. Knowing how the brain processes information helped researchers to better understand the thought processes of students and in turn develop better ways of educating the students.

A Change in Science Education over the Past 25 Years

With science knowledge growing each day, the sheer volume of scientific information is overwhelming, and it is impossible for any one person to master all science fields. Over 70,000 different journals publish new science findings. Knowing

how humans learn has helped educators in all fields better develop curriculum that would correspond with students' methods of learning, but this knowledge has truly helped science educators figure out how to approach their specific content area.

In 1982, the Reagan administration released *A Nation at Risk*, which advocated for another education reform. This reform recommended that science courses give attention to how science and technology information plays a role in lives, both socially, as well as environmentally (Gardner, 1983). The concepts covered would relate to the lives of students, but in this initiative, there was a focus on how students learned the information. Along with the drive for science education embedded in everyday life situations, the instructional delivery of science education became another focus. An integrated science curriculum built upon instructional practices that lead to an increase in the depth of knowledge of a student, advancing the student curiosity for learning, and intensifying the science of daily life (DeHart-Hurd, 1991). Researchers believed that incorporating higher order thinking skills made students gain a deeper understanding of the topics covered causing a greater retention rate of information. Although instructional delivery was a key issue, it was still important that the curriculum support the students in understanding how science affects their everyday lives.

In the 1990s, the National Research Council developed the National Science Education Standards, in an attempt to focus the nation on intense instructional practices to help develop productive citizens in the science world. Just like Project Synthesis. The National Science Education Standards has four goals, students will do the following:

1. Experience the richness and excitement of knowing about and understanding the natural world.

2. Use appropriate scientific processes and principles in making personal decisions
3. Engage intelligently in public discourse and debate about matters of scientific and technological concern.
4. Increase the economic productivity through the use of knowledge, understanding, and skills of the scientifically literate person in their careers (National Research Council, 1996, p. 13).

With the development of these goals, the focus altered for students to utilize science in their everyday lives. The goals also centered the attention on the delivery of science applicable to the students and their lives; through text that is regarding current issues and problems that are to be solved through their investigations.

When President George W. Bush came into office, a law passed called No Child Left Behind. This law focused on setting standards for student achievement and establishing criteria for highly qualified teachers (Lynn, 2008). With the development of this law, increased science standards were set in some states, and this once again turned attention to science education. Now a new president, President Obama, is pushing for education in a program called Race to the Top. All new reforms push for a change in all areas of education, including science.

A push for concept-focus teaching. Throughout the history of science education there have been many issues that have raised concern with educators and politicians that deal with educational issues. The education field has realized that the scientific method and hands-on science are both major pieces in student learning of science. Once more was learned about how the brain processes information into memory, teachers realized

that teaching science should utilize concepts that build upon each other. Today teachers face the challenges of making decisions of what and how to teach (Duschl, 2008). Teachers are overwhelmed with more knowledge available than ever before on understanding how and when a child learns best.

At the middle school level, science education focused for many years on a general science alignment, where teachers cover a little bit of an individual topic each year. This led to a choppy science curriculum, as well as repetition of information because teachers would go over information that was covered in earlier years. This spiraling curriculum concept leads to a large overlap of information. One author completing a study about spiraling curriculum received this answer when questioning a student about the overlap of information, "So that it's, like, branded in our brains, so that we know it forever" (Caldwell, 2008, p. 3). As a teacher, I do not actually want to "brand" items of information in a student's head, but instead help them to understand the concepts at a deep level. The spiral curriculum leads to science content taught throughout a school year that is not utilizing a flowing method, causing students to refocus their minds to new concepts, instead of building on prior knowledge already covered that year. With the shifting of topics, students may lack understanding of how certain concepts are related. Quality rather than quantity should be the goal in science classrooms.

The spiraling curriculum, common throughout many districts throughout the United States, may lead to students feeling bored and frustrated. In Caldwell's study, she interviewed students regarding their feelings toward a spiraling math curriculum (Caldwell, 2008). Caldwell's study found that students are not sure why they are repeating work, and are not appreciative of having to cover information that they have

already know (2008). Although Caldwell's study focused on math, the idea of a spiraling curriculum is relatable to science as well.

Throughout the many educational reforms, the importance of teaching of the scientific method in the classroom was significant. With the implementation of standards developed through the No Child Left Behind reform, the next debate is how to teach the standards and grade level expectations utilizing the best way for all students to learn. The committee called Taking Science to Schools (TSTS) has recommended that K-8 science instruction be coordinated around doing science and letting the students discover (Duschl, 2008). In previous years, in many science classrooms across the nation, science focused on a topic approach. Intermediate and middle school topics would consist of plants, animals, and rain forest, just to name a few. The topics would be taught as units and not necessarily relate to the science concepts involved in that topic. Teachers also tend to miss opportunities to connect the information in the classroom to other disciplines (Eberle, 2008). Teachers need to take into account how all items overlap in science, as well as other subjects.

Once standardized tests became the focus of the nation and science was included, schools began to realize that the science test scores were low. One reason for this was a lack of well-written curriculum. States started aligning curriculum to the state standards that were in place. The standards represented what the students should know by the time they graduated high school. Schools began examining their approach on how to teach science to increase the test scores, meeting the standards set by the state. Science educators realized that the focus was not on what students know, but on how they come to know and develop the scientific knowledge (Duschl, 2008). There is greater retention

of information if students can explain the development of how a piece of information was learned. For example, if a student can explain that sunlight is necessary for a plant to grow because he or she participated in a lab that tested plant growth in various forms of light, then he or she will be more likely to retain the knowledge about plants needing sunlight to grow. The TSTS gave the rationale that science teachers need to facilitate learning the core science knowledge (Duschl, 2008). Teaching the core science knowledge would allow students to learn the base and apply the knowledge to other areas of science. Seeing how sunlight helps plants grow, could allow students to inquire about what else sunlight helps.

Teachers are encouraged to move away from topic focused teaching into concept focus teaching. An example of topic focus is found in the teaching of a unit on plants, where an example of concept focus teaching would be living systems. If a teacher were teaching to the topic of plants, he or she would cover concepts about the plant and ask students to memorize parts and their functions. In a topic education setting, when asking students what they were learning about, they would simply respond, "plants" (Olson, 2008). The student would generally study for the test and memorize everything about the plant, but when the sapplication of information is necessary to a similar process, to the students, the transmission of information to relate the two topics typically goes unrecognized. In general, a student would not be able to relate how the structure of a plant helps sustain life in the plant and compare the information to another living system. Teachers need to focus on specific concepts in a concrete format and develop around the concept allowing the students to transfer the knowledge in a more abstract way. If a teacher would teach the concepts of the function of the plant parts and how they work

together in a system, a student could move the knowledge to other living structures as well as nonliving structures. Research shows that presenting knowledge in both concrete and abstract terms is far more powerful than just doing science labs (Huebner, 2008). A teacher will have better luck with students retaining the information learned if they teach using several styles of learning with the same concept.

This brings about the idea of concept- or system-focused teaching. A teacher needs to pick out the "big idea" such as support systems of living organisms and develop lessons that provide examples of this (Olson, 2008). Once students see several concrete examples, and how each part plays a role, they should be able to transfer the knowledge to other items. To transfer knowledge learned from a concrete example to an abstraction, students need appropriate guidance (Huebner, 2008). With the appropriate guidance, the students will start seeing patterns instead of content (Llewellyn, 2009). This is not that a teacher cannot use the idea of plants, but memorizing the parts of a plant should not be the focus. Instead, use of each part should become the focus and a plant should not be the only example given.

For a student to learn the big idea, a teacher should use multiple exploration phases that lead the students toward developing a concept that ties the explorations together. Seeing numerous examples focused on one concept would help the students to better understand the exploration and develop a conceptual understanding of the big idea (Olson, 2009). Multiple explorations regarding the same big idea allows learners that are more abstract to see patterns. In a topical approach explorations are as single entities, causing many students to miss the connection between the topics. Whereas, in a concept-focus teaching environment, the students will recognize patterns and more likely be able

to understand the underlying concepts of how the explorations are related. Using the living systems example; after a student learns about the living systems of a plant, the teacher should then bring in other examples, such as the structures for the human body, or even structure of a company, and students should begin to see how all things in a system need to work together to have success. Teaching systematically around a big idea leads to students thinking more critically and design intelligent solutions (Llewellyn, 2009).

In conjunction with teaching to the big idea, various other factors address teaching the curriculum to the fullest potential. Realizing that students have prior knowledge including misconceptions about the topic is one of the major keys to success of teaching to the big idea. The teacher should consider the misconceptions that pre-exist and scaffold lessons in a format that moves toward the desired learning (Olson, 2009). No lesson is fully scripted, because each class might walk in the room with different misconceptions (Olson., 2009). Moving the students past the preconceived notions to the factual information on the topic is a major step in teaching around the big idea.

A second factor for educators to consider when teaching to the big idea is the necessity for the effective instructional strategies. Dr. Robert Marzano has produced great work in defining effective teaching strategies guidelines for teachers to follow (Marzano, 2007). His book walks teachers through the different instructional strategies that are effective for teachers. Ineffective strategies, such as lecturing the materials and explaining to the students their results, would leave the curriculum weak even if aligned around the big idea.

There are four steps to working toward developing a curriculum around big ideas.

1. Determine the standards necessary to comprehend to obtain the big idea.
2. Develop a flowing sequence of necessary topics and determine the transitional events that occur to move smoothly into the next focus and guiding to the big idea.
3. Look for missing parts.
4. Plan out the details of lessons on how to achieve the big idea (Olson, 2009)

Along with following the four steps of planning, a teacher should also develop the essential questions that the students should be able to answer throughout the unit and decide what lessons answer the essential questions. The state standards should act as a guide for teachers when developing the essential questions for the unit. Standards give an overall view of the concepts that students should know when completed with specific grade levels. The use of standards to guide essential questions, combined with units designed around the big ideas, provides a basis in which students should have retained the standards.

Olson stated, "Teaching to the big idea requires that instructional experiences be carefully selected and sequenced so that students' understanding is built over time and results in a deep conceptual grasp of the standard" (2008, p. 48). The experiences selected should also lead toward the answering of the essential questions, which in turn leads to greater understanding of the big idea. As well as developing the essential

questions, the teacher must also consider the research-based effective strategies that lead to greater understanding of the big idea. Using different strategies, such as small group and whole class activities, hands-on projects, and journaling, to teach the concepts reaches out to all learners. Designing a unit around the big idea, and including the necessary components, such as essential questions and effective strategies, requires the teacher to have a strong grasp of the content, knowing the logical progressions and well-orchestrated behaviors (Olson, 2009). Elementary teachers could have as little as three classes that include science (Department of Elementary and Secondary Education, 2010). Middle school is the first time students have been taught by a content expert. Middle school certification requires a major in the content taught. Knowing many elementary teachers' lack of science knowledge, it is necessary for middle school teachers to cover in depth the topics. Additionally, science content knowledge can change rapidly with technological advances. For example, Pluto is no longer considered a planet.

The Change Process

Change in any organization or school can be difficult. It leads to feelings of anxiety and skepticism when there is uncertainty in the outcome. The key is for the leader to determine how to make the change process a smooth transition for all stakeholders involved. Leaders need to understand the viewpoint of the stakeholders as the transition process occurs, to ease the tension that employees might present. James Malm, a researcher who studied change at six community colleges, stated, "Leaders must be able to overcome entrenched interests and gain the commitment of stakeholders with different values to meet external demands and change organizations (Malm, 2008, p. 615)"

The need for change. Change happens for a number of reasons in many organizations. Sometimes companies are not running smoothly, and a need for change arises. On the other extreme, sometimes-external factors drive an organization to change (Cummings, 1999). Companies will find a need for change during growth or economic downturns (Burge, 2008). This is no difference in schools. At times schools are not running smoothly, so there is a need for change, while other times there are factors that have changed in the community, or new requirements from the state that drive a change in the school organizations. Simon Sinek wrote a book called, *Start with Why*, which helps companies and schools to understand that it is necessary to know why a change process is taking place (Sinek, 2009). Companies need to start with the question, "why?" Why is it necessary for the change? What outcome is being looking for? Understanding why the change is taking place, pilots the direction for the change (Sinek, 2009). In a school, recognizing why a change is necessary allows the stakeholders to comprehend the urgency.

Feelings of employees. There will always be resistance to change (Burge, 2008). The crucial factor for the leader of change is perceiving the feelings the employees go through and working through the feelings. A key step in relieving the tension of change is cluing the stakeholders in on "why" the change is necessary (Sinek, 2009). When stakeholders feel they know why change is occurring, then their mindset is more understanding. There are three stages in the stakeholders' attitudes toward change: shock, denial, and acceptance (Burge, 2008).

Shock and denial. When the subject of change originally comes to the attention of stakeholders, there often becomes a state of shock throughout the company (Burge,

2008). Employees come to work daily thinking they are doing the best job possible and working in the right direction. When production is determined to be not "good" enough and change is needed, it is understandable the shock that employees go through. Once the shock wears off, employees tend to move into a state of denial (Burge, 2008). Teachers can relate to this if test scores are not meeting the expected standards. Teachers put in an enormous amount of time and effort toward the lessons they teach, and to tell them that the students did not meet standards, they feel of disappointed and shocked. Again, employees believe they were already producing to their fullest and change is not possible. Informing the stakeholders concerning why the change is necessary and using data to support the change, gives them a broader picture and moves them past the denial stage (Sinek, 2009). Explaining why change needs to occur with data to support leads to honest communication and trust gained from the stakeholders to the leaders (Thomson, 2010).

Acceptance. Once the denial has passed, stakeholders move onto the acceptance stage (Burge, 2008). When employees are open and accepting to the change process, they tend to push through the necessary steps to succeed (van Dam, 2008). Each level of stakeholders (for example in a school: parents, students, teachers, etc.) bring important contributions to the success of the business, making it extremely necessary to gain the trust and commitment of all stakeholders involved (Burge, 2008). When acceptance occurs and all stakeholders are committed, the change process can begin. "Again, full support at each level of the organization is absolutely dire to optimal results" (Burge, 2008, p. 36).

Leading the change. "Effective leaders initiate and foster organizational change and innovation" (Malm, 2008, p. 614). The change process can be a complex task to handle, which is the main reason the right leader must be in place to make the changes. The change process occurs in eight stages (see figure 2):

a. Urgency: It is necessary to create a sense of urgency of why the change needs to occur NOW (Kotter, 1996). Giving a sense of urgency makes people realize the nessesity for change. One of the greatest challenges for a leader is having the stakeholders realize the magnitude of the necessity to change (Burge, 2008). Leaders can overcome the challenge quicker, if the urgency is greater.

b. Partnership: Create a positive working community amongst all the stakeholders involved in the change process (Kotter, 1996). A partnership is developed so that all stakeholders can share ideas and be aware of the progress that is made during the change process (Burge, 2008). It is necessary for leaders to establish employees to become their "change agents" (Arrata, Despierre, & Kumra, 2007). The ones who are determined "change agents" are the employees who embrace the change process and other employees trust and respect the work they produce (Arrata, Despierre, & Kumra, 2007). The "change agents" provide leaders with connecting to the whole group (Ackerman, 2008).

c. Vision: A common vision should be developed in addition to a strategy designed to reach the common vision (Kotter, 1996). "School leaders must convey a clear vision of challenging standards-based goals while creating a professional environment conducive for instructional changes" (Wong & Nicotera, 2007, p. 30). Leaders, along with the stakeholders, develop common goals to reach the

vision (Thomson, 2010). The goals provide definitive points to reach and allow the group members to see progress.

d. Communication: Communication needs to be an open door policy, where stakeholders are able to ask questions and bring forth ideas to help lead toward the vision (Burge, 2008). The vision and goals communicated with all stakeholders involved, so everyone is striving toward the same outcome (Kotter, 1996). A leader should create an effective communication system to thoroughly follow throughout the change process (Burge, 2008).

e. Provide: It is necessary for the leaders to provide the stakeholders with the necessary items to reach the goals (Kotter, 1996). Providing the stakeholders with the needs allows progress to take place at a quicker rate. If it is up to the stakeholders to find their own needed items, then companies lose valuable time in reaching the goals.

f. Celebrate: It is necessary to celebrate the successes (Kotter, 1996). Goals determine the success of the company, so when a goal is achieved, then celebration occurs. The more celebrations, the possibility of creating more power occurs (Blankstein, 2004). Celebrating the short-term wins helps the stakeholders to keep moving forward (Kotter, 1996).

g. Embrace Gains: A leader should acknowledge the gains and communicate how the gains made will lead toward greater success (Kotter, 1996). Illustrating the data points to the stakeholders allows them to see gains (Thomson, 2010). Displaying the progress keeps the change process striving forward.

h. Security: Leaders must embrace the change that has occurred and let it show what the company stands for (Kotter, 1996). This gives the company a sense of pride for the achievements. It also builds the groundwork for further progress.

Change is inevitable. Having the right steps in place can make the change process run smoother. Along with the right steps in place, having the right leader and "change agents" in place, help the progress to flow efficiently. It is necessary for all stakeholders and the leader to be working together toward a common vision, with open communication, so success can occur.

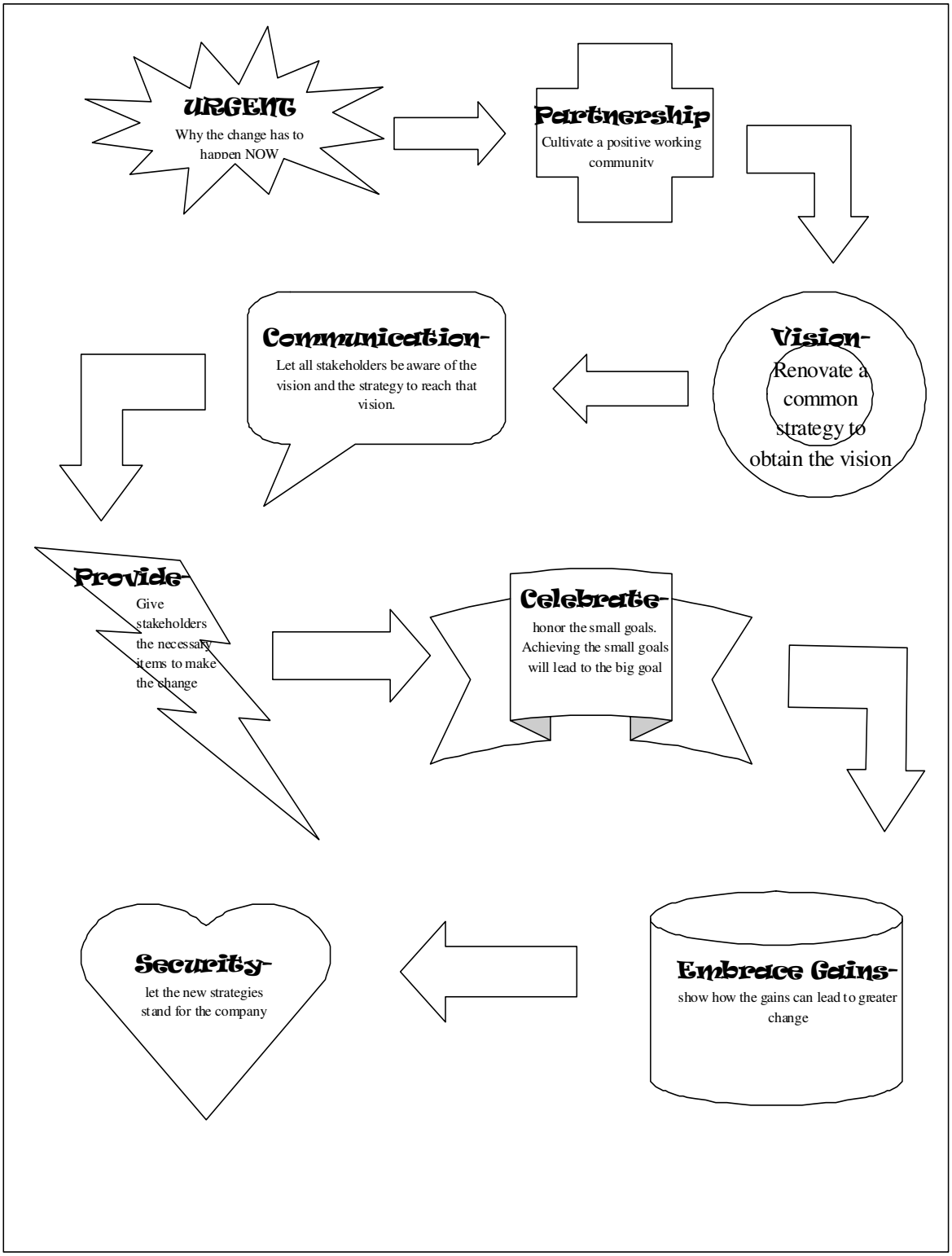

***Figure 2*: The Change Process**

Professional Development

The ideas motivating science education have greatly changed over the last 100 years, and the new era is no different with the push for concept focus teaching. Teaching the concepts of science requires a teacher to plan major parts of the lessons. First, when planning, the teacher needs to develop the essential questions related to the state standards. These questions should align with each other so that concepts are related and can grow as the students progress through the lessons. Secondly, the teacher must take into account the misconceptions of the students and develop lessons that work to overcome the preconceived notions. Third, effective instructional strategies need to be put into place that lead the students toward the concept. Along with effective instructional strategies, the teacher should use multiple explorations to allow the students to develop an understanding of the concepts. With all factors in place in an instructional setting, there is a hope for greater retention and in turn greater standardized test scores.

Designing professional development to match 21st century skills.

In a growing society, workers face daily challenges in their jobs. This is no different in school situations, except teachers and school leaders have a heavy load when considering the students. All actions teachers and leaders take in a school in some way effect students. "Teacher quality has been widely shown to have a large impact on student achievement" (Saderholm & Tretter, 2008, p. 270). Schools need to take into account everything that goes on in the school to help lead students to success. Looking at Hayes Mizell's quote, for school leaders and teachers to be effective they need to remove themselves from the problems that occur in the school (Reeves , 2010). Schools need to

change the professional development of the 21st century to help the leaders and teachers become part of the solution**.**

A change in professional development. Professional development is "a program of activities designed to enhance the professional knowledge of groups of teachers" (Torff & Sessions, 2008, p. 124). Considering this description of professional development it would seem the existence of professional development has been present for several decades. Over the years, there has been an increase in the amount of necessary professional development (Torff & Sessions, 2008). As times have changed, so have the knowledge and skills needed to keep pace with a changing world.

In October 1957, the Russians launched the first unmanned aircraft, *Sputnik*, into orbit (Zhoe, 2009). The launch of *Sputnik* changed American education forever (Zhoe, 2009). The belief that the United States was deficient in science and technology education motivated the federal government to pass the National Defense Education Act in 1958, allowing for federal funds to be used toward education (Zhoe, 2009). Money was then available for schools to incorporate more science and technology education, allowing teachers to receive a broader range of knowledge to reach the students (Zhoe, 2009). With the enhancement of science and technology education, teachers would most likely need an increase in professional development to implement the new available science and technology education. An ongoing development of educational reforms throughout history has become a foundation for changes occurring in teacher qualifications (Torff & Sessions, 2008).

Teachers, "as with other professionals in other disciplines, should continue to enhance their skills and stay current with the developments in the field" (Torff &

Sessions, 2008, p. 123). The development of educational reforms has increased teacher qualifications, as well as the professional development yearly requirements. In previous years, many teachers would pick and choose the professional development opportunities they wanted to attend, most taking place outside of the school (Torff & Sessions, 2008). Now, professional development is no longer a choice of teachers, but required by the federal and state governments (Lieberman & Wilkens, 2006). Expectations are that teachers not only participate in district-mandated professional development programs, but also continue to receive enough professional development or higher education classes to sustain their certification (Lieberman & Wilkens, 2006). District mandates concerning professional development have increased greatly over the past couple of decades, often times causing schools to focus on "hot" topics of the time (Lieberman & Wilkens, 2006). Although some teachers would find particular workshops interesting and relevant to their particular content area, not all were useful for each and every teacher (Lieberman & Wilkens, 2006). With an increase in using student data to drive instruction in the classroom, there must be a change to professional development in the 21st century to help reach proficiency for all students.

21st Century Professional Development

Our society is ever changing, with new ideas and gadgets (e.g. ipad, texting, etc) popping up every day. One cannot predict what new jobs will exist in 10, 20, or even 30 years. Teachers are working to prepare students to be able to function and thrive in society. Future generations will need to be able to increase productivity and diversify to be prepared to enter into the world, be it the work force or higher education (Stone, Kaminkiski, & Gloeckner, 2009). The Chief Executive Officer of Marriott International,

J. Willard Marriott, stated, "To succeed in today's workplace, young people need more than basic reading and math skills. They need substantial content knowledge and information technology skills; advanced thinking skills, flexibility to adapt to change; and interpersonal skills" (Fletcher, 2007, p. 26). School leaders are starting to realize that students are graduating from high school unprepared for the future (Fletcher, 2007). Implementing the necessary skills to move into the future in the everyday classrooms will help students learn the skills as well as the information (Fletcher, 2007). Schools need to focus on how and what the teacher is teaching, causing for a shift in professional development of teachers (Reeves, 2010)

School leaders have realized the need for change in professional development for teachers to ensure the success of students (Reeves, 2010). Since participation in professional development is required of all teachers, school leaders must provide meaningful and relevant professional development to ensure teacher buy-in. Schools with 90% implementation of professional development by the faculty show three to five times higher achievement than schools with only 10% implementation (Reeves, 2010). This is a key factor for schools to consider as they look deeply into the professional development that they are offering. According to Doug Reeves (2010) in *Transforming Professional Development into Student Results,* there are three essential characteristics for effective professional development:

1. Focus on student learning
2. Rigorous measurement of adult decisions
3. Focus on people and practices, not programs

Embedding these three characteristics into all professional development to a great extent will assist in leading to high impact professional learning (Reeves, 2010).

It is all about the students. Steven Paine, a leading superintendent for a school district that is ahead of the game in 21st-century learning, simply says, "Go talk to the kids. They'll tell you that simply raising the rigor of the traditional experience isn't going to improve their outcomes" (Gordon, 2009, p. 20). What we do in our classroom should focus on the students' education. High expectations for all students are necessary, but it is our job as teachers to ensure the meeting of the expectations and find the way to create an environment in which they exist (Reeves, 2010).

Everything in a school should focus on the students. Schools around the country develop vision and mission that spell out what the expectations are about the school, solely focusing on the student outcome. The vision and mission represent the overall goal of the school; it is our job to figure out how to achieve that goal. This is where schools should incorporate alignment of all capacities of the school (Mooney & Mausbach, 2008). Everything that takes place in the school needs to align, with student success as the primary focus. In the book *Align the Design* by Mooney and Mausbach, alignment is, "integration, efficiency, and connectivity among the most essential work for school improvement" (Mooney & Mausbach, 2008). The majority of schools' mission and vision statements focus on producing lifelong learners and preparing students to be quality citizens. In every school there are at least a few students struggling, which means that no one school is fulfilling their mission and vision with 100% success, concluding that there is still work to do in all schools. Student data needs to be collected to help determine an action plan for school improvement (Mooney & Mausbach, 2008). This

data determines the needs for the school, which in turn will help determine the needs of the teachers met through professional development (Mooney & Mausbach, 2008). Once the professional development provides teachers with the necessary information or skills, school leaders need to follow through with supervision to verify the implementation of the initiative (Lieberman & Wilkens, 2006). Feedback from teachers and school leaders, as well as student data gathered from formative assessment, will determine the success of the initiative and any necessary further professional development (Reeves, 2010). All events taking place in the school should happen to improve student achievement.

When implementing professional development designed around school improvement plans geared toward successful student achievement, Doug Reeves believes several measures need maintained. The first item to consider is the needs assessment to establish the shortfalls that exist in the school (Reeves, 2010). From the needs assessment the school should prioritize and focus deeply on three to four (Reeves, 2010). Deeper implementation, quality over quantity, will lead to greater student results. The goals that are set up need to be in a SMART (S=Specific, M=Measureable, A=Achievable, R=Relevant, T=Timely) goal format (Reeves, 2010). Goals need to be monitored by the leadership team using a rubric, so that teachers are receiving feedback regarding the implementation of the professional development received (Reeves, 2010).

Classroom Standards to School Standards

To give teachers a way to measure success of students, it is necessary for teachers to develop the essential standards they are expecting the students to master (Ainsworth, 2003). The state provides teachers with standards to teach, but it is necessary for teachers to determine the power standards or the most essential standards in the curriculum

(Ainsworth, 2003). To determine power standards, the first focus is to determine which standard has the most advantage, meaning the one that affects other disciplines (Reeves, 2010). Standards with the greatest advantage are important because without proficiency of these standards, the student will have difficulties in other areas. Secondly, when establishing power standards, teachers need to determine the standards that are relevant for a great length of time throughout the content area (Reeves, 2010). Relevance is important as the skills build upon each other. All teachers want their students to come prepared with all the necessary skills from the previous grade, which brings in the third characteristic for choosing a power standard: essential for the next level of learning (Reeves, 2010). Determination of the power standards completed in collaboration with all the teachers of the same subject and grade level area will lead to greater buy-in and implementation (Reeves, 2010). Working together allows for the determination of what is truly most important.

Power standards give the teacher a goal for the lessons they are implementing in the classroom (Ainsworth, 2003). Lessons developed around a specific standard with small formative assessments along the way to determine proficiency of the students on meeting the standard (Ainsworth & Vuegut, 2006). The teacher should know how to recognize a skill, and determine the best practice to teach the skill (Gossman, 2008). The teacher must use his/her expertise in the subject area and collaborate with colleagues, as well as the data from the formative assessments to determine the necessary instruction to implement to move every student towards proficiency of the standard. Analysis of results for the individual students determines the necessary measures to achieve proficiency (Reeves, 2010). Looking at student data closely allows teachers to see gaps in student

learning and re-teaching can occur to fill in those gaps. "Students are given many "second chances" instead of being judged" (Zhoe, 2009). Understanding that all students learn at a different pace causes for differentiated instruction in the classroom; allowing all students to meet the expectations.

Just as teachers implement curricular standards in the classroom, as an overall goal of what students should learn, school leaders should implement professional development standards in the school (Reeves, 2010). Professional development standards for a school should be determined on a needs assessment and focused on student learning (Lieberman & Wilkens, 2006). The professional development committee (which should include teachers and administrators) determines the standards prior to the beginning of the year, and all professional development in-services focus on these standards (Reeves, 2010). Including stakeholders from all aspects of the school in the development of the standards allows for all consideration of a variety of views. Setting professional development standards will keep the faculty focused on meeting proficiency of those standards and give the ability of deeper impact of the standards (Reeves, 2010). The leaders will assess the teachers on the standards and determine insufficiency of individual teachers determining the necessary actions to assure all teachers are meeting proficiency (Reeves, 2010). Just as teachers differentiate in the classroom, leaders will have to differentiate in professional development opportunities.

For professional development, initiatives to be effective they need to be highly implemented (Reeves, 2010). High implementation means that what the teachers have learned in professional development sessions is recognizable in the classroom at the fullest extent. If full implementation of the initiative occurs, the school will receive gains

of 11.65%, where on the other hand if low implementation occurs there actually are no gains, but a loss of -17.74% (Reeves, 2010). Considering these statistics truly shows that schools should choose a limited number of initiatives to work towards, so implementation is at a greater degree.

From Teacher to Instructional Coach

With an enhanced focus on using data to drive instruction, it is necessary for teachers to know how to educate students in areas where they are not proficient (Reeves, 2010). We no longer live in a society where we simply teach and give grades; we have moved into teaching to insure learning, even if that means re-teaching the skills (Stone, Kaminkiski, & Gloeckner, 2009). We truly are now instructional coaches. Doug Reeves uses the analogy of a coach and an athlete. If an athlete does not perform the skill with perfection, the coach does not simply say okay and move on, he provides the athlete with feedback regarding where there is room for improvement and how to make those improvements (Reeves, 2010). We, as teachers need to act as if we are coaches in the classroom, explaining to the students where the errors are occurring, as well as the steps to fix those errors, and then provide the students with an opportunity to meet excellence. A coach supplies an athlete with steps to meet perfection. Just like the coach, it is essential for teachers to instruct with steps to lead to the deepest understanding.

The leaders in the school need to act as instructional coaches to the teachers as well. When standards have been set and the professional development provided to meet that standard, school leaders need to focus on providing teachers with constructive feedback on their performance on meeting the standard (Reeves, 2010). Teachers receive professional development to provide greater instruction to the students of the school, so it

is necessary to provide teachers with comments regarding strengths of implementation, as well as areas of weakness and the steps necessary to implement the standard to the greatest extent. The degree of guidance each teacher needs to meet the standard will vary, causing for some differentiated professional development for the teachers (Reeves, 2010). A school that has successful professional development is one that "provides the opportunities for application, practice, reflection, and reinforcement" (Reeves, 2010, p. 23). Teachers and leaders of the school need to act as if they are coaches, giving teachers feedback and a second chance at becoming successful in the implementation of the initiative. This would have a direct link to student results, because school leaders are working with the teachers to work to become the most effective teacher he or she can be (Reeves, 2010).

From Schools to Professional Learning Communities

A significant aspect of 21st century skills is collaboration (Reeves, 2010). According to dictionary.com (2010), the definition of collaboration is to work together, especially in a joint intellectual effort. Students need to work collaboratively in the classroom, the same goes for teachers in the school. With this in mind, schools across the country have become professional learning communities (DeFour & DeFour, 2010). "These collaborative and collective effort requires educators to function not merely as groups, but as teams-people working *interdependently* to achieve a *common* goal for which members are *mutually accountable"* (DeFour & DeFour, 2010). If a teacher has a struggling student in his or her class, the teacher should bring data to support the struggles of the student and the professional learning community team should analyze the data and collaborate together to determine the best approach to help this student succeed

(Reeves, 2010). Two (or more) heads work better than just one. As part of the professional development initiatives integrated into schools, the in-service sessions should focus teacher learning in a professional learning community aspect; allowing teachers to work together to discover the best way to implement the strategies (DeFour & DeFour, 2010). After applying the strategy learned during professional development, professional learning communities give teachers a time to reflect on the strategy together, judging the strengths and weaknesses of the implementation, as well as determining if further training would help implement to the fullest (Reeves, 2010). Professional learning communities' key focus of collaboration should surround the students' education (DeFour & DeFour, 2010). All teachers are collaborating to help students reach their fullest potential.

Conclusion of Professional Development for the 21st Century

With multiple educational reforms taking place throughout history, our ideas of professional development have changed. Twenty-first century professional development needs to focus everything that takes place in a school or professional learning community on a central focus, that being the students. All professional development provided should have the students' success as the key focus. The standards determined by the professional development committee should focus on supporting student learning (Reeves, 2010). The school leaders have the duty to insure that the objectives of the standards implemented into the classroom with the greatest of efforts and determine the success of implementation (Reeves, 2010). If a school leader finds that a teacher is not meeting proficiency on a standard, he or she needs to provide that teacher with continuous professional development on the specific initiative (Reeves, 2010). Schools

need to focus on the quality of implementation, rather than the quantity. Students gain more when initiatives are at the highest degree of implementation. Changing the professional development provided will help take the teachers out of the problem and make them part of the solution, leading to increased student results.

Summary

With all the different amounts of change that have occurred throughout the history of science education, it is imaginable the number of transition processes schools have gone through to create the greatest science education possible. It is no doubt that new initiatives will continue throughout the future years, stressing for the deep understanding of the steps necessary to take place for a successful transition process. A key factor to implement new initiatives to the fullest is to include strong professional development. To understand the components of change and the implementation that the necessary measures, by the leaders of the school, will lead to a stronger execution of the initiative. The following chapter will look into a science curriculum change at the New Heart School district that had taken place at the start of the 2009-2010 school year.

Chapter Three: Methodology

A Change of Direction

At the start of the 2009-2010 school year, with the direction of, Jan, the new science coordinator, the science teachers in New Heart School district agreed to change the alignment of the science curriculum to arrange the topics taught to each grade level to concentrate on one specific field of science, referred to as a field-focus alignment. Surrounding school districts that have arranged their curriculum into a field focus curriculum has seen an increase in state test achievement scores. With this new arrangement, where each grade focuses on a specific field of science, the New Heart district hoped to promote an increase in MAP scores, since accreditation of the district consists mainly of meeting AYP expectations, which measures the performance on the MAP test. The district will not be able to see the full outcome of the new alignment of curriculum and the subsequent effects on the MAP scores until three years into the new curriculum arrangement, when the 2009-2010 sixth grade students will be completing the eighth grade MAP test in 2012. This study took place during the first year and half of the implementation process, not allowing the researcher to note the full results for the New Heart School District.

This study used an interactive model approach as described in Joseph A. Maxwell's book, *Qualitative Research Design: An Interactive Approach.* Maxwell's structure is interactive, as well as flexible and interconnected (Maxwell, 2005). His work designs a structure that is set up in a format that shows how each part of the model is related and how they work together.

Type of Study

This qualitative study will investigate the innovation process of implementing a new alignment of the science curriculum at the middle school level in the New Heart School district. A qualitative study examines how the process of variable x connects to variable y, rather than simply establishing that the relationship exists (Maxwell, 2005, p. 23). In other words, this study will describe and examine the process of implementing the new science alignment. The study will outline the process of the innovation, from the birth of the idea, the organization of the innovation, the implementation of professional development to integrate the innovation, the ongoing changes to the innovation, as well as recommendations make the transition smoother.

Research Questions

Question 1: What process did my district, and surrounding districts utilize when making a transition to a new curriculum alignment in middle school science?

Question 2: What challenges were my district and surrounding districts faced with when making the transition to a new science curriculum alignment?

Question 3: How do teachers perceive the transition process, specifically the related professional development in my district?

Question 4: What recommendation of strategies for middle school science does the state of Missouri give?

Question 5: How do the curriculum materials and teacher resources support the grade level expectations mandated by the Department of Elementary and Secondary Education?

Goals

Goals are important for a study, because they give the researcher what he or she is striving to achieve. Goals come in various forms; personal, practical, and intellectual (Maxwell, 2005, p. 16). The personal goal(s) are the ones closest at heart of the researcher. They drive why the researcher is completing the study and allow gratification for the work put into the study. These goals are not always necessarily important to the readers (Maxwell, 2005). A practical goal for a study meets a need, changes a situation, or achieves an objective (Maxwell, 2005). These types of goals give the study an outcome to achieve. The last type of goal discussed by Maxwell is the intellectual, which enlightens the reader on the process of what is studied (Maxwell, 2005). The following goals are those I attempted to achieve through the study:

- *Practical*: To understand the steps necessary to endure during the transition from a spiral science curriculum to a field focus science curriculum at the middle school level.
- *Intellectual*: To highlight the process taken when transitioning to the field focus curriculum. Why did the district move to this alignment? What structures are in place to help insure success of the innovation? What suggestions would help another school make the same transition run smoother?

Conceptual Framework

Why complete an investigation of the innovation of a new science curriculum alignment? It is important to know the processes that schools follow to implement an innovation. In a field that is becoming more data-driven, understanding the progressions of the execution of a new idea is truly important. If another district were considering the

same type of innovation, the methods and results achieved by the New Heart School district may help alleviate some of the hurdles that would otherwise take up valuable time and frustrate everyone involved, thus allowing for a deeper focus on the data, as well as the outcome of greater student achievement.

Considering the recommendations provided in chapter five would allow school districts to see the challenges that they could avoid. To understand the hurdles or detours that might exist prior to the implementation of an innovation allows school districts to be better prepared for the journey and increases the ability to put procedures in place to avoid the distractions. While this study focuses on science curriculum alignment, some of the findings could be generalizable to similar districts making transitions in other subject areas. Although middle school is the subject of this study, the findings may also be helpful to elementary schools or high schools considering a similar transition. The recommendations could also relate to other subject areas, not just the science curriculum transitions.

When analyzing qualitative research, there are different aspects to consider, since there is little, if any statistical data to analyze. The implementation of an innovation will go through the processes that are necessary to help make the innovation successful. I will examine the background information to understand the need for the innovation, the process put into place prior to the innovation, the professional development that guided the innovation, and the continuous strategies that exist along the way to insure success.

Background Information for Implementation of New Innovation

Implementing an innovation, such as field-focused science curriculum alignment, does not come about in one day. Instead, Jan, the new science coordinator, presented the

team with research and data regarding field-focus curriculum. She had spoke with surrounding school districts, as well as the state science coordinator, which presented the idea of aligning the curriculum with in a field-focus manner. The decision was based off the research and data that Jan presented, as well as the team members' perceptions surrounding the transition process.

Interviews

To understand all the background information I conducted interviews. Interviews allow the researcher to gain knowledge and understanding of information about the individual's views on a professional issue. It gives helpful information, not otherwise available in another aspect of research. The interviews gave me the opportunity to learn information about the process from the perspective of the leader. The leader has a much different view compared to the perspective of a classroom teacher.

All interviews completed include a recording via audiotape. This allowed me to listen, transcribe the information given to me, and further analyze the answers to the questions. The advantage of audiotape is the ability to go back and re-listen to the information provided by the interviewee to understand to a greater extent the meaning behind the answers provided. A greater understanding leads to a deeper interpretative phenomenological analysis on the experiences of the transition process.

I conducted all interviews personally, and they ranged from 15-45 minutes long. Interviews initially conducted were via an e-mail conversation with a follow-up phone call interview to gain a greater understanding. The e-mail interviews allowed me to gain background knowledge about the district and asked very direct questions. The phone interviews allowed me to go in-depth to gain a better understanding. During

transcription, I removed all names and other identifying information. I will refer to all participants using pseudonyms to preserve confidentiality. The school district name is also a pseudonym. The interview questions can be found in Appendix C.

New Heart School District science coordinator interview. The first person to interview was Jan, the new curriculum coordinator of the New Heart School District. The questions I asked her began with her background and experience and then focused on the idea of the transition between a spiral-science curriculum to a field-focused curriculum. I also asked questions regarding analysis of the school data, and her inspiration for approaching the science teachers with the innovation. See Appendix C for the list of semi-structured interview questions.

When interviewing Jan, there were several limitations, one that she was the curriculum coordinator in the current district in which I worked. Another limitation was that the actual initial transition step took place over a year ago, which affected how fresh the information was in Jan's mind. Although this was a limitation, I believe she was able to provide reflection on the process, because the district is further into the transition.

Surrounding school district science coordinator interviews. I interviewed the science coordinators in the surrounding area districts that have aligned their curriculum to concentrate on specific fields at each grade level: a field-focus alignment. The science coordinators in the surrounding area participated in a group e-mail, through which Jan, my science coordinator, initially asked which schools had made the transition to the field-focus curriculum. Jan provided me with the names of the coordinators who had made the transition, so that I knew whom to contact. Out of the group of ten coordinators who are part of the e-mail group, two of them responded to having a field-focus curriculum

alignment. The others who responded but had a spiral curriculum alignment and thus were not interviewed for the study.

The two districts that responded had a wide contrast in demographics than the New Heart School district. The districts ranged between 70-75% white. Although the demographics were quite different, the information to gain is still worthwhile. I contacted the two coordinators by e-mail with my initial questions, and followed up with a phone call to gain deeper knowledge. Interviewing the coordinators allowed me to get a further in-depth understanding of how other districts have accomplished the alignment of their curriculum. It also allowed me to see the order they have chosen for the arrangement of their science topics and how many years the arrangement had been in place in that specific way. Interviewing the curriculum coordinators also allowed me to gather a better understanding of the supplies or science kits that the districts used and the type of professional development put into place or offered to the teachers. See Appendix C for semi-structured interview questions.

Interviewing the surrounding districts' science coordinators allowed me to compare the process of their transition to that of my current district's process. Although no two districts are the same, it allowed for a larger amount of information gathered, so I was able to make valid recommendations for future studies based on a variety of data. The limitations I faced when interviewing surrounding district coordinators was the number of years their districts had been utilizing a field-focused curriculum since progressing through the transition process. However, as with my own science coordinator, this added information as they reflected on the process.

The science consultant for the Missouri Department of Elementary and Secondary Education. When interviewing the New Heart district science coordinator, she had stated that when considering making the transition, one of the people that she had spoke with was the science consultant for DESE. Knowing she spoke with him, it was a good idea for me to interview him as well. This interview was conducted via e-mail, as that is was the quickest way to gain the information. The science consultant for the Missouri Department of Elementary and Secondary Education is a person who district coordinators turn to for guidance in decision-making regarding curriculum. Interviewing the science consultant gave me an idea of the support that is in place for science coordinators throughout the state of Missouri. The interview provided insight to understand Missouri's official interpretation of the various beliefs concerning the alignment of the middle school science curriculum. See Appendix D for interview questions.

Surveys of New Heart Middle School District teachers. In addition to the interviews, I conducted a survey for the middle school science teachers of the New Heart School District. I developed the survey questions. The questions were not piloted prior due to a lack of access to a pool of teachers who had experienced a similar transition. The completion of the survey is through an internet site, which allowed for confidential collection of the data and easy analysis. The survey should have taken the teachers between 5-10 minutes to complete. I used a Likert scale for the survey, a scaled rating of completely disagree, disagree, neutral, agree, and strongly agree. I sent the survey via e-mail to 33 teachers and provided them with one week to complete the survey. I sent two follow-up e-mails that reminded the teachers to take the survey, as well as to thank those

who already had. I had 20 of the 33 teachers complete the survey. (There are 36 middle school science teachers in the district, but two are new, and one is the researcher) The data provided information on the teachers' perceptions of the transition process. It also provided me with the teachers' perception of the professional development offered by the district. See Appendix E for a copy of the survey.

Student Achievement Data

To value the idea for an innovation, there needs to be an understanding of the need for change. The Missouri Assessment Program (MAP) gave each district a breakdown of student scores as compared with the state expected benchmark scores to determine the success of the students of the school. The MAP test development came about due to the mandate outlined by the Outstanding Schools Act of 1993 (Department of Elementary and Secondary Education, 2010). This law passed and required schools to give a performance-based test that would monitor the progress of students along the way throughout elementary, middle, and high school. The creation of the MAP test involved all stakeholders, including parents, teachers, and business professionals throughout the state (Department of Elementary and Secondary Education, 2010). According to the Department of Elementary and Secondary Education (DESE), the MAP test judges the effectiveness of educational programs and services offered at the local level (Department of Elementary and Secondary Education, 2010). The MAP test is the only standardized measurement that all schools in this study give, due to requirements by the state. The MAP score determines the success of schools as determined by the Department of Elementary and Secondary Education using guidelines developed under the mandate of

the No Child Left Behind Act. Analysis of the MAP results, as demonstrated in the chart below, for the New Heart School district supports the need for a change.

Table 3

Breakdown of 8th Grade Science MAP data from New Heart School district

Year	# of Students Reported	% Not Proficient	% Proficient	State Average
2008	1,481	80.4	19.6	43.3
2009	1,488	77.9	22.1	45.2
2010	1,450	70.7	29.3	48.4

(From Missouri Department of Elementary and Secondary Education)

The state average for the 2010 school year for the 8th grade science MAP results was 48.4% proficiency. The information from Table 3 indicates that, the New Heart School districts' 8th grade science scores are weak. In 2008, only 19.6% of the students scored proficient, with a gain of 2.5% points in 2009, moving the proficiency mark to 22.1%. With only a slight increase in scores, the district, under the guidance of the science coordinator, knew it was necessary to take a strong action to improve the science MAP scores.

Population

During the 2008-2009 school year, the New Heart School District had approximately 18,855 students enrolled, with 1,488 in the middle school (Department of Elementary and Secondary Education, 2010). The district was quite large with 31 different schools, 3 high schools, 6 middle schools, 19 elementary schools, and 3 early childhood schools. Representation of the demographic data for the New Heart School District is in Table 4.

Table 4

Demographics of the New Heart School District of the 2008 and 2009 school years

Category	Year	Number of Students	% of District
Total	2008	19,160	
Asian	2008	187	1.0
Black	2008	12,811	66.9
Hispanic	2008	276	1.4
Indian	2008	7	0
White	2008	5,879	30.7
Free/Reduced	2008	8,705	46.1
Category	Year	Number of Students	% of District
Total	2009	18,585	
Asian	2009	201	1.1
Black	2009	12,664	68.1
Hispanic	2009	280	1.5
Indian	2009	25	0.1
White	2009	5,415	29.1
Free/Reduced	2009	9,788	52.9

(From Missouri Department of Elementary and Secondary Education)

The demographics of the New Heart School district are approximately a 70-30 split between black students and white students, with a small percentage falling in the other categories of ethnicity. The district's free and reduced lunch count has risen to over 50% of the population qualifying, based on family income.

The population of teachers affected by the innovated transition from a spiral-science curriculum to a field-focus science curriculum is 36 middle school science teachers, with six middle schools in the district and six science teachers located at each middle school (two per grade level).

Process and Analysis

To help understand the process of the science curriculum alignment change, I will review the different steps involved in implementing the transition from spiral curriculum, to the new style, field-focused curriculum. The process involved planning which grade level should focus on which field, as well as how to align the different aspects (or science kits in New Heart's situation) in each grade level.

Summary

I have been a science teacher in the middle school since 2003. It is my job to insure coverage of all the necessary grade level expectations, so that my students are prepared to enter the eighth grade and complete the MAP test at the end of the year. I have experienced firsthand from a teacher's point of view the trials and tribulations of making a transition of curriculum alignment change. Interviewing the coordinators who have gone through the curriculum alignment change allowed me to understand the background information for the process and issues from a leader's perspective. The interviews in addition to the secondary MAP data and teacher surveys will lead me to make suggestions for future districts completing curriculum alignment transitions in chapter five.

Chapter Four: Results

The purpose of this study was to investigate the transition from a spiral science curriculum to a field-focus science curriculum. I investigated the steps taken by the New Heart School district when making the transition, as well as compared the transition process to that of other surrounding districts. This chapter provides an analysis of perception surveys from the middle school science teachers of the New Heart School district. I will also explain the results of the interviews I conducted with surrounding school district science coordinators that have made the transition and how they compare to New Heart School District's transition process. The interview conducted with the educational consultant of science for the Department of Elementary and Secondary Education will explain if the transition process aligns with the view from the state of Missouri.

The following questions provided guidance for the investigation:

Question 1: What process did my district, and surrounding districts utilize when making a transition to a new curriculum alignment in middle school science?

Question 2: What challenges were my district and surrounding districts faced with when making the transition to a new science curriculum alignment?

Question 3: How do teachers perceive the transition process, specifically the related professional development in my district?

Question 4: What recommendation of strategies for middle school science does the state of Missouri give?

Question 5: How do the curriculum materials and teacher resources support the grade level expectations mandated by the Department of Elementary and Secondary Education?

Curriculum Alignment Change from the view of New Heart School District Science Coordinator

As a teacher, I was part of the transition process to a field-focus science curriculum alignment in the New Heart School District. I knew what the perspective was as a teacher but needed to investigate the district science coordinator's view. The transition took place at the start of the 2009 school year, the district coordinator's first year in the district. I interviewed the coordinator to gain her perspective. The following is a narrative based on my interview with her.

Upon moving to the New Heart School District, the coordinator found a population of science teachers with low morale. The science teachers had previously felt a lack of guidance and support from the previous district science coordinator. The new coordinator had to gain the trust of the science teachers. She approached them with optimism and enthusiasm, to help ease some of the tension that had developed.

To develop a sense of urgency, the science coordinator presented the science teachers with the facts regarding the weak MAP scores. This did not come as a huge surprise to any of the science teachers, as the districts science MAP scores had been weak for several previous years. The science coordinator explained how she spoke with the state science coordinator regarding the district's seeing the largest gains and highest MAP scores. After reviewing the data, it was clear that these schools had arranged the curriculum to be field-focused, allowing the teachers to dig deeper into the subject

matter. A month after becoming part of the district, the start of the new school year was approaching and all the science teachers returned for the beginning of the year professional development. At this time is when the district coordinator presented the teachers with the idea of moving in the direction of a field-focus curriculum.

The science coordinator explained to the teachers that the transition to a field-focus science curriculum is typically a three-year process, as the implementation would start with the sixth grade the first year, move into seventh grade the second year, and the third year include the eighth grade. With each teacher only teaching one specific grade level, that would put the focus of the new alignment on the sixth grade teachers the first year, adding in the seventh grade teachers the second year, and finishing out with the eighth grade teachers the third year. After three full years, all curriculum would be set up in a field-focus science alignment. The previous year new science kits were implemented throughout the district. As with many new implementations, teachers did not stay on pace to cover all of the kits. This led to a vast majority of teachers not covering the necessary grade level expectations the previous year. Taking this into consideration the teachers decided to make the transition immediately, with the seventh and eighth grade teachers agreeing to teach primarily field-focused, but filling in the missing gaps from the previous year. The New Heart School District's transition process will take a full three years to implement fully, but the process was different from the original plan of the transition process.

Once the timeline was established in a morning meeting, the placement of science fields to each grade level was made that afternoon due to the amount of time the teachers had to begin the transition process. School started in a week, so decisions were made

quickly. To decide the order of the fields in the grade levels, the coordinator explained the basis of the curriculum started with a strong ecology unit already placed in the sixth grade. With the input of the coordinator and teachers it was determined that sixth grade would keep the ecology unit giving them the life science field. With the eighth grade teachers making the transition and filling in gaps on areas previously missed, it made sense for them to have the field with the least number of grade level expectations to cover, placing Earth science in the eighth grade. This left seventh grade with the physical science field. This type of field arrangement also allowed each grade level to start the year with a unit previously taught in that grade level, making the beginning of the transition year less stressful for the teachers.

In discussing the strengths of the transition process, the science coordinator explained that the teachers were a strength especially the second year were. The coordinator stated, "The teachers were great. They were enthusiastic." As the coordinator viewed classroom instruction and spoke with teachers, she noticed that there was more in-depth instruction taking place.

The science coordinator indicated that one of the greatest original challenges presented was helping the teachers view the grade level expectations as a "span" of middle school grade level expectations. The grade level expectations have specific benchmarks for each grade level. The coordinator had to explain that although the document appears in such a format, that does not mean those are the requirements for that specific grade level, but instead that as long as a middle school level covers the information, then the district is still following the expected state guidelines. As long as all the GLEs are covered by the end of the 8th grade, then students will have the

information necessary for the standardized test given at the end of their 8th grade year. The teachers of the district were unaware of this previously, so it took explaining the different point of view to them to help them fully buy in to the transition to a field-focus curriculum.

The amount of time to make the transition to a field-focus curriculum alignment presented a challenge to the coordinator as well. With the teachers making a decision to move so quickly, and the science teachers only having two days to meet with school starting in a week, the changes had to take place at a fast pace. Looking back this was not the ideal situation, but the science teachers were determined to make the transition all at once. Along with time, the coordinator mentioned that more funding would make the transition process easier. With more funding then there would be less sharing of materials between grade levels. In the initial year of implementation, each grade level was given kits specifically for their classrooms. When it was determined that kits would be shared between different grade levels, there was not enough funding to buy new kits, instead, the teachers would have to transition them from one classroom to another. In some cases this was not a problem, but if two grade levels needed to cover the same information that year, then teachers would have to collaborate, making sure the coverage was not overlapping.

Working as the coordinator of a school district moving to a field-focus curriculum, the greatest strength was the buy-in of the teachers. All teachers wanted to see improvements, and the coordinator presented the data to show that a field-focus science curriculum could lead to the improvements. With the challenges of time and

changing the view of grade level expectations taken into consideration, the transition process went smoothly in the eyes of the science coordinator.

Surrounding School Districts

To get a view of the transition from multiple perspectives, I interviewed two coordinators from surrounding school districts that have made the same transition from a spiral science curriculum alignment to a field-focus curriculum alignment. The interviews provided me with the information regarding why the transition took place, what strategies were in place to move into the transition, and what hurdles the district faced during the transition process. The interviews provided me with more information of the process and outline of the transition process.

Order of fields. The order of presentation of information could play a role in the outcome on the MAP test. Determining the order is an important contribution to making the transition to a field-focus curriculum alignment. The order of instruction plays a role in the coverage of information during each grade level at the middle school level.

One district coordinator I interviewed, whose district made the transition to the field-focus curriculum alignment at the beginning of the 2010 school year, had the same unit alignment as the New Heart School District: Grade 6- Life Science, Grade 7- Physical Science, and Grade 8- Earth Science. The coordinator in that district explained the GLEs compelled the determination of the order. The GLEs determined by the state for the field of Life Science are ideas that are more concrete, because students can relate to the topics more, with topics such as food webs. Students are part of the food web, so they tend to understand the information easier. The science coordinator felt the lessons are easy to understand and of high interest to the students. The more tangible and

concrete ideas, made sense for the sixth grade level to take on the grade level expectations of Life Science. The Earth Science grade level expectations had the least amount of information to cover, which made the determination that eighth grade would take on these. With eighth grade having the least number of grade level expectations to cover, it allows for time to review prior to the MAP test. The placement of Earth Science in the eighth grade is that unless taken as an elective, this is the last time students will receive lessons on Earth Science in their school career. With the placement of Life Science in sixth grade and Earth Science in eighth grade, that left seventh grade to cover the Physical Science grade level expectations.

The other district where I interviewed the science coordinator had alignment set up as follows: Grade 6- Earth Science, Grade 7- Life Science, and Grade 8- Physical Science. The coordinator was not in her current position when the transition took place, but stated that teachers were assigned their particular grade levels due to their strengths in the subjects and areas of certification. The district made the transition to a field-focused curriculum alignment beginning around the start of the 2002 school year. The district also has some of the highest science MAP scores in the state. The MAP middle school science scores for this school district are displayed in Table 5.

Table 5

Grade 8 MAP data for One Surrounding School District with Field-Focus Curriculum Alignment

Year	Basic/Below Basic Percentage	Proficient/Advanced Percentage
2008	28.9	71.1
2009	31.5	68.5

2010	23.9	76.1

(*From Missouri Department of Elementary and Secondary Education)*

Structures in place for transition. Both surrounding school district coordinators determined that communication is key in promoting a positive science community within the school district. Science teachers, both laterally and vertically across grade levels, need to communicate with each other to gain an understanding of information covered. It is also necessary for communication to be constant, because budgets necessitate sharing supplies amongst grade levels. One coordinator explained how they documented curriculum, lesson plans, tests, labs, video clips, and ideas on a district wide curriculum database, so that everyone had access to the information. Neither surrounding school district used the same kits as the New Heart School District, they instead used a different curriculum company. This communication tool helped the teachers see what others were doing and allowed for collaboration.

Both districts mandated some professional development opportunities, as well as offered voluntary workshops the teachers could attend. The mandated professional development would take place during the time the district had set aside in the school year for professional development. On the other hand, the voluntary professional development consisted of after school meetings that the teachers could attend to collaborate, discuss the transition, and work through problems that might be occurring. Both districts also made their teachers aware of any outside workshops that were available on science and encouraged them to attend. Neither district coordinator could provide an exact number of science teachers who attended the outside conferences. Professional development provided teachers with opportunities to further their knowledge of best practices to implement the classroom.

A Summary of the Strengths and Hurdles of the Transition from all Coordinators Perspective.

The field-focus science curriculum alignment allowed for common pacing and planning across the grade level. This strength allowed the teachers to collaborate, bringing together multiple perspectives on curriculum and implementation ideas. Another strength of a field-focus curriculum alignment was the opportunity for teachers to be able to skip past determining the prior knowledge the students had received, because the teachers already knew the information they taught in the field. Taking away covering prior knowledge provided the teachers with a greater amount of time, in which they could go deeper into the information, giving the students more knowledge. The field-focus curriculum alignment provided the teachers and students with the opportunities to make easier connections between the topics. Since the topics built on each other, the information is relatively new in the students' memories.

The main hurdle that schools came across when making a transition to a field-focus curriculum alignment, and probably any transition, was that teachers generally do not like change. Good communication and professional development helped to overcome the hurdle. When making the transition, there were certain grade levels that had to share materials, so the materials had to move from classroom to classroom. It was necessary to have a specific process for moving the curriculum. When making a transition to a field-focus science curriculum, teachers were covering new material, which elevated the learning curve amongst the teachers. Providing teachers with the necessary professional development, as well as providing opportunities for teachers to communicate vertically across grade levels helped alleviate some of the frustrations endured by the teachers.

New Heart School Districts Teacher Perspective on the Curriculum Alignment Change

To retrieve the teacher's perspective concerning the change in the curriculum alignment, I conducted an online survey. An anonymous survey allowed teachers to answer questions without the chance of scrutiny for providing their true feelings. The survey of the middle school science teachers of the New Heart School District consisted of six questions with a scaled answer, ranging from strongly disagree to strongly agree. The survey also included three short answer questions, allowing the teachers to express their thoughts through words. I sent the survey out to 33 teachers, giving them one week to respond. I had a response rate of 61%, with 20 out of 33 responding.

Two of the survey questions provided information regarding the professional development that involved the transition from a spiral science curriculum to a field-focus science curriculum. In any new initiative implemented into a school, strong professional development related to the new initiative allows for greater buy-in and deeper execution (Reeves, 2010). Understanding the teachers' thoughts on the professional development of the transition from a spiral science curriculum to a field-focus science curriculum allowed me to determine if the implementation process was effective.

The first question concerning professional development was regarding the original implementation of the professional development to move to the field-focus science curriculum. The question asked if the professional development was sufficient to transition to the field-focus science curriculum. The results were not overwhelming in either direction. Forty percent of the teachers agreed that the professional development was sufficient to move into the field-focus curriculum. Fifteen percent of the teachers

remained neutral, while the other 45% remained in disagree or strongly disagree categories. A representation of the data is in Figure 3.

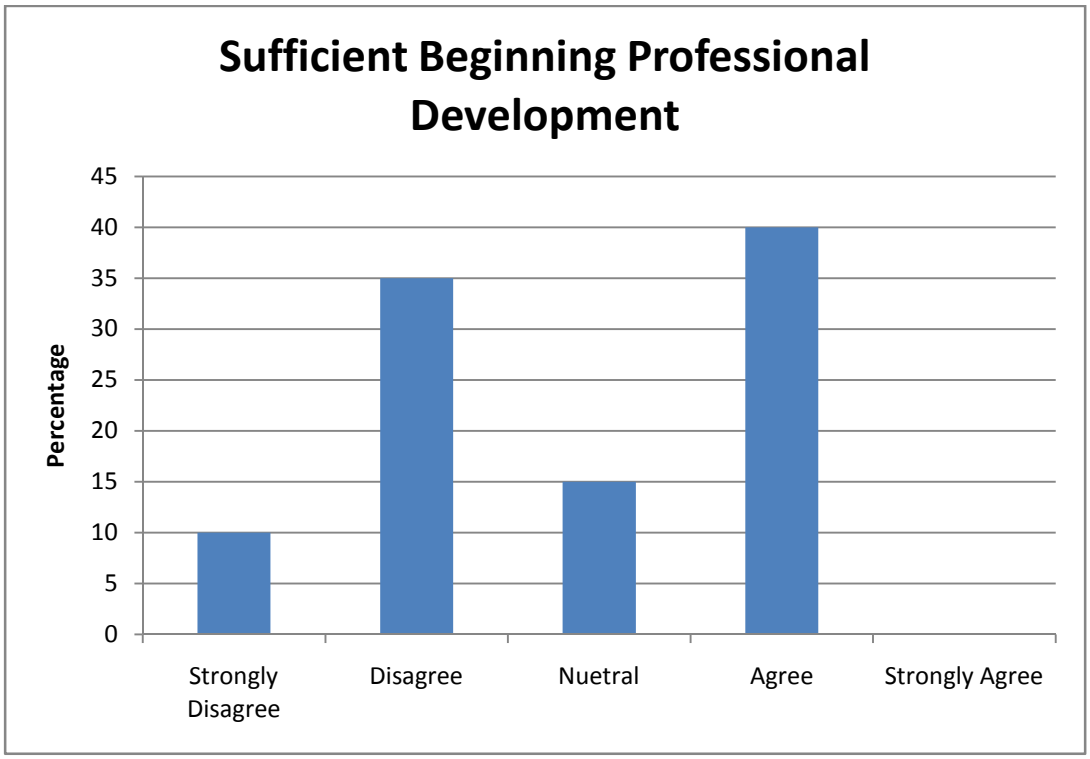

Figure 3

Sufficient Beginning Professional Development

The second professional development survey question regarded the follow-up professional development. Offering multiple professional development opportunities on the implementation of an innovation allows for insurance of understanding (Reeves, 2010). The teachers responded that the follow-up professional development was not sufficient, with 65% answering disagree or strongly disagree. Thirty percent remained neutral on the topic, and only 5% agreed that the professional development was sufficient. Figure 4 shows the data in a graph form.

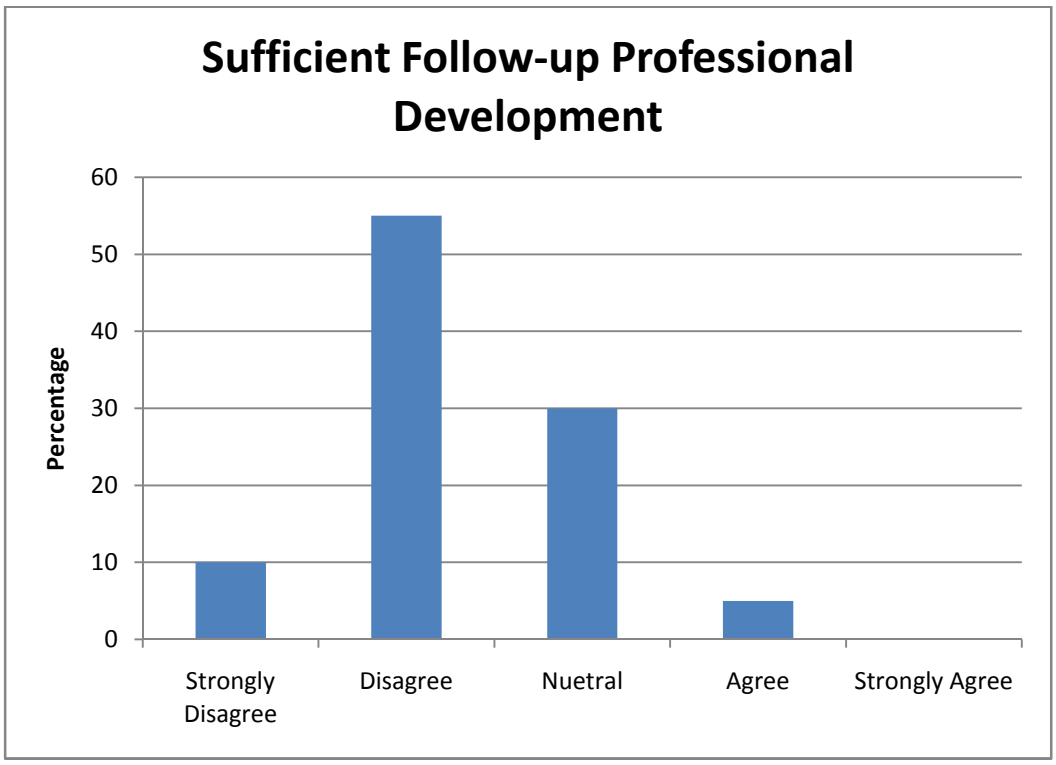

Figure 4

Sufficient Follow-up Professional Development

One question on the survey asked the teachers if there was a sufficient amount of guidance provided throughout the transition process. Just as, with the follow up professional development, the teachers felt the guidance provided was not sufficient. Neutral and disagree combined for 90% (40% answered neutral and 50% answered disagree) of the teachers' feelings concerning the guidance provided for the transition process. Representation of the data is in Figure 5.

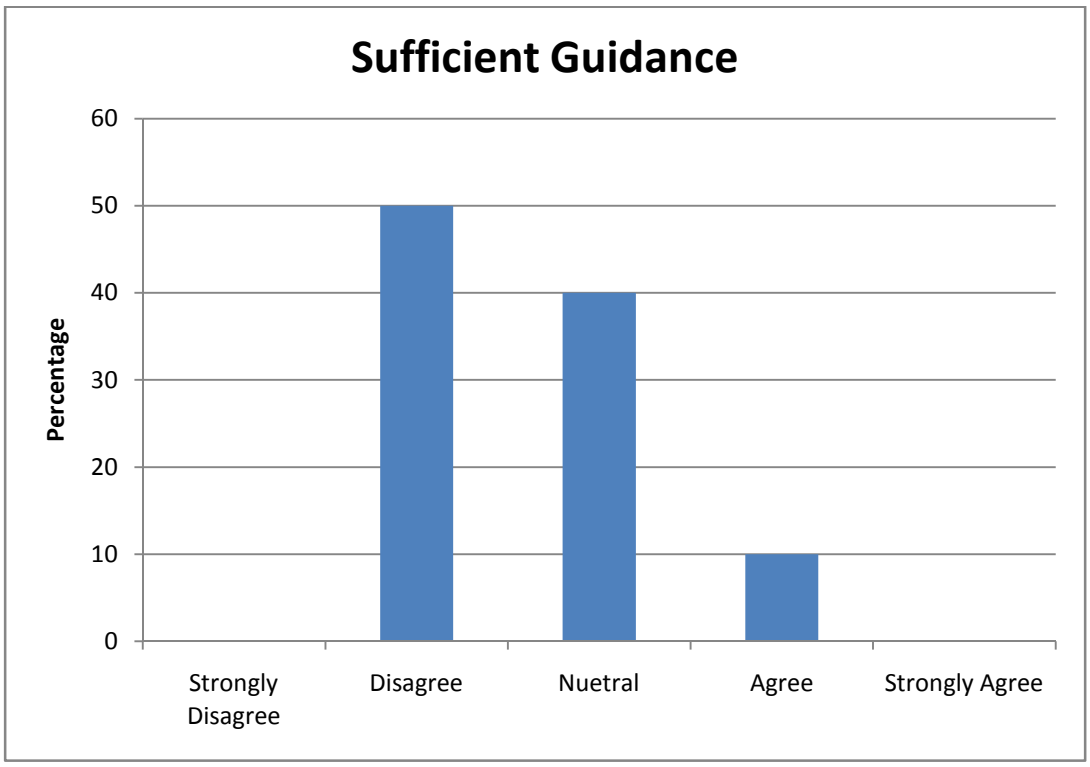

Figure 5

Sufficient Guidance

The pace of a transition can make or break the implementation process. In the case of the New Heart School District, the decision to implement the field-focus science curriculum came quickly. Considering this, I asked the teachers a question regarding the pace of the transition process. Forty percent of the teachers determined the transition pace to be sufficient, while 25% remained neutral. The remaining 45% disagreed or strongly disagreed. A representation of the data is in Figure 6.

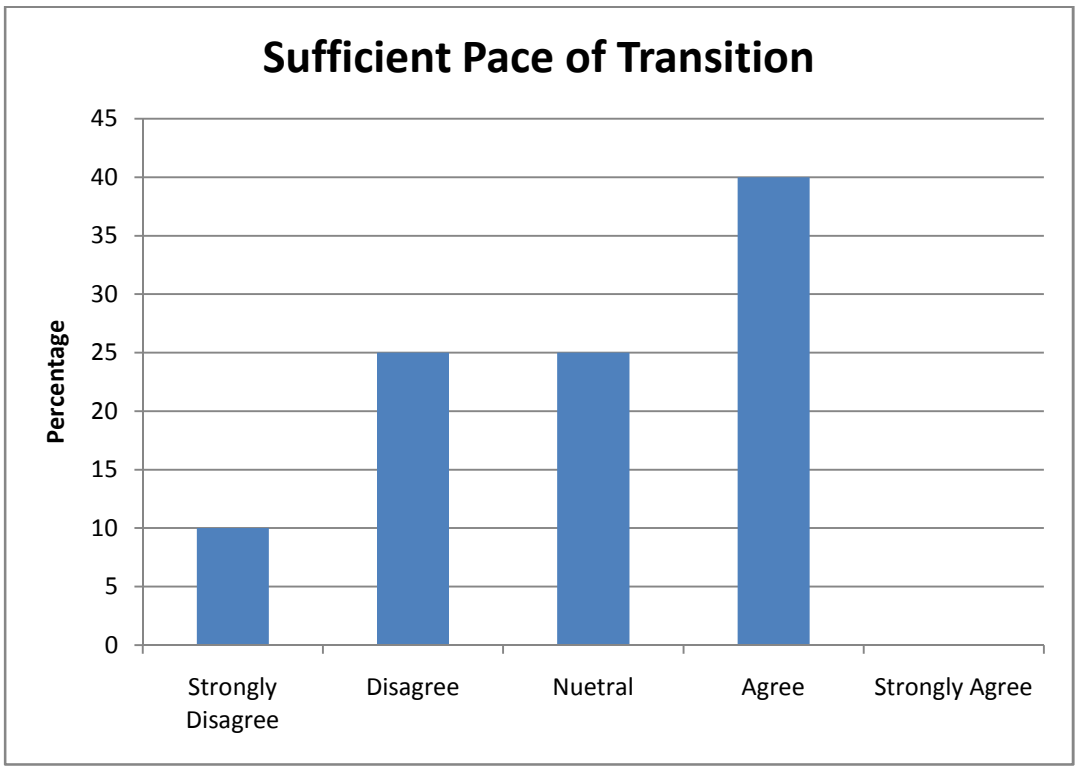

Figure 6

Sufficient Pace of Transition

The implementation of a field-focus curriculum alignment will hopefully lead to an increase in 8th grade MAP scores. Although the true outcome for the New Heart School district will not be determined until 2012 MAP results are available, one of the survey questions asked the teachers' perspectives on benefits of the field-focus curriculum. A majority (60%) agreed or strongly agreed that the field-focus alignment benefited the students. Thirty-five remained neutral, while only 5% strongly disagreed with the field-focus alignment. A representation of the data is in Figure 7.

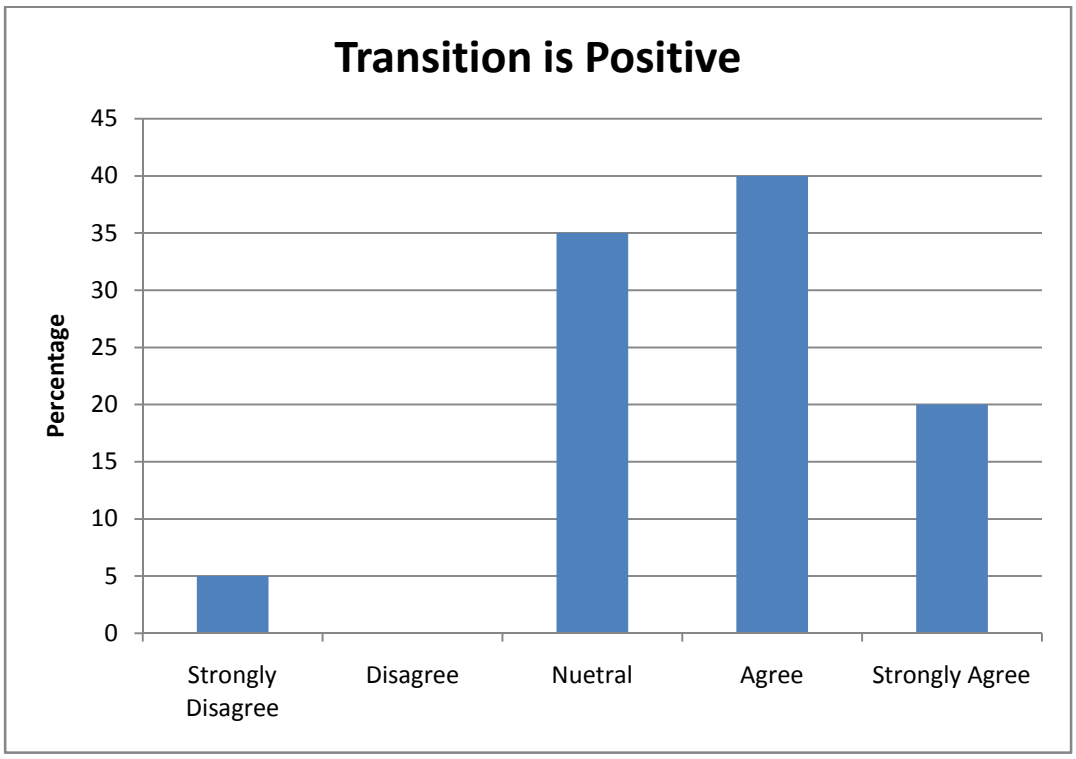

Figure 7

Teachers' perspective on if the transition is a positive factor for student learning.

Since the middle school science teachers in the New Heart School district had recently made the transition, I also asked a couple of open-ended questions. The responses provide true feelings of suggestions and hurdles from the teachers' perspectives. It will help drive my suggestions for Chapter 5.

The first question was if the process started over, give three suggestions for what should be kept or what should change. The strongest comment that teachers made regarding change is the amount of time of preparation. One teacher commented, "Switch before the first weeks of school so we have a chance to prepare." From many of the comments teachers felt rushed and overwhelmed switching so quickly. Another recommendation to implement was to increase the communication throughout the district,

between schools, as well as grade-levels. With such a large district, it is hard to know where everyone else is having challenges, and a time for collaboration would help alleviate some of the struggles. "There needed to be on going opportunities for teachers to communicate throughout a grade level across the district. It would have helped in the implementation and helped better combine given materials." Another suggestion for change was to increase professional development opportunities throughout the transition process.

Overall teachers did not give many suggestions on what to keep. One teacher suggested that, "field focus topics in years they are now taught." The alignment of topics seems to work positively in the current grades, so there is not a need to change. Several teachers also suggested keeping collaboration, although some felt the collaboration could increase to a higher level.

The second open-ended response question asked the teachers to give suggestions to keep the transition process going. The majority of the answers given all focused on collaboration among the teachers across the district. Once comment stated, "The teachers across the district need to meet in person at least once a trimester." Teachers wanted to meet with grade level teachers to see what is working and what is not working, as well as vertical grade level meetings, to discuss with teachers who have previously taught the units. "Increase communication between grade levels to indentify common themes or concepts and ensure that students have foundational skills needed for each grade level." Collaboration and professional development are key in continuing the transition process.

The last question asked to teachers is what input did they have on the implementation process. Five of the twenty teachers who answered did not feel as if they

had any input in the implementation process. Another five of the teachers simply felt like they were just able to agree to make the transition. The other ten felt as if they were able to give a little bit more input including where to place which kits, placement of fields in grade-levels, and deciding if supplemental material was needed. Some teachers felt as if they had input, while others simply felt as if they had none.

Missouri's Perspective on Curriculum Alignment

To gain the state of Missouri's official perspective on the alignment of middle school science curriculum, I interviewed the person holding the position of educational consultant for science at the time of this study, for the Missouri Department of Elementary and Secondary Education. The consultant had held his position for three years. Interviewing him helped me to gain a perception of the recommendations the state gave districts when selecting the curriculum alignment.

The consultant shared that the state itself could not require the districts to set up the science curriculum in a specific way for the middle school. If a district science coordinator approached him for guidance, he may have made recommendations in the form of questions that the district should answer prior to making their choice on alignment. When a district science coordinator approached him for advice, he looked at what the schools were currently doing and first looked at the teaching styles implemented in the district. He would ask questions about teaching styles such as whether cooperative learning and inquiry were taking place within the classrooms. Without strong teaching, the content taught does not matter. A teacher needs to be using best practices to implement the material. It was necessary to insure the instruction is at its peak prior to focusing on the curriculum alignment.

The latest trend the state was seeing was that of a field-focus trend. The consultant believed that the transition was taking place with the development of end of course exams at the high school level. There was not currently end of course exams in the middle school science area, but there were suggestions that more science assessments were a possibility in the future. Currently, only eighth grade students were tested in science; while in high school, students were tested at the end of each course through an end of course exit exam.

If a district was making the transition to a field-focus science curriculum alignment, the consultant recommended the first step was to look at the materials the district was using. If the district was using textbooks and simply following the order, this created a hindrance, because textbooks often did not teach deep enough to focus on understanding the GLEs. Textbooks teach a large quantity of information, but often time's misses the quality and deepness of specific topics. Making sure the materials provided gave a deep understanding and lent itself to a field-focus alignment is crucial for the success of a field focus curriculum.

To determine what grade levels to place the fields of science, the consultant suggested building from at the teachers' strengths. The consultant also suggested looking at the mathematics that was necessary for each field of study and insuring that students will have covered the material prior to using the same math concept in science. A simple example is in the physical science field the students must know how to complete speed problems using a formula and equations. It is necessary that students know and understand how to set up formulas to solve equations and can bring that knowledge with them to science class.

Although the state could not give required directives on the alignment of curriculum, the state consultant could give recommendations when asked in the appropriate format. The wording of the recommendation makes it apparent that the districts were actually making the choice of what curriculum alignment. Districts were tending to move toward a field-focus alignment due to the possibility of end of course exams moving into middle school science.

The Transition from My Perspective as a Teacher

I remember quite clearly the first day of professional development at the start of the 2009-2010 school year. The New Heart School District science coordinator approached a group of us and said that schools that are seeing an increase in state standardized test scores were moving to a field-focused curriculum alignment. She asked us, the group of teachers, if this is the way we wanted to go. With such poor test scores, it seemed we all agreed quickly to make the transition.

The coordinator explained how it would take three years to make the transition because the first year sixth grade would implement the transition, the second year the seventh grade would implement the field-focus alignment, and the third year eighth grade would implement the alignment. As a teacher, I was thinking a three year transition seemed like a long time, but if that was what it would take, then that is what we would have to do. Then another one of the teachers suggested that since we just started with the new kits the previous year and did not make it through all the necessary kits, why not we make the transition now. At the time, it seemed to make sense to all of us and we pushed for the idea. The coordinator was hesitant but still went ahead and called for approval

from the interim superintendent. Also, she reluctantly agreed to let us go forward and make the transition in one year.

The next decision made during that same professional development session was what field each grade level would teach. At the time, my main concern was school starting in a week. I mainly wanted start with a kit that I had previously taught, Earth and Space, or Energy, Machine, and Motion. Everyone seemed to agree that this strategy was necessary with the school year starting so quickly.

The next item discussed was to determine the order of the kits at each grade level, so that we could determine when the kits needed to be moved across grade levels. Once it was determined that grade levels would not be covering the material at the same time, the teachers from each school determined when the moving of materials would take place. This was the last of the discussion until we moved materials and no further conversation about the transition took place until the professional development day at the beginning of January.

The beginning of the January professional development day we, the seventh grade science teachers, determined a pacing guide to teach the Properties of Matter unit. (The following year we would incorporate the Chemicals Interaction Unit along with Properties of Matter, but it was not necessary because the sixth grade teachers covered Chemical Interactions the previous year.) After this decision, we discussed breifly about common assessments, but time did not allow for a determination of all common assessment decisions. With the calendar provided by district, this was the last mandatory professional development of the year. Unfortunately, the completion of common

assessment decisions did not take place until a year later at the following January professional development.

As a teacher and researcher, there was not enough communication that took place during the transition process. The few times teachers would meet, we would discuss about the problems we had, but we never had a chance to determine solutions. The district calendar did not allow for sufficient professional development during the transition year.

Summary

Transitioning to a new curriculum alignment takes a great deal of planning and development. District leaders gain knowledge and insight from state level educational consultants on directions other leading districts have taken. The consultant cannot direct the districts to align the curriculum in a certain way but can ask questions to guide the district coordinators to a plan that will work for them and their district. A key component a leader needs to keep in mind when transitioning to a new curriculum alignment is the attitudes of the teachers. Understanding all aspects of the change process will help a transition move smoother. The next chapter will answer the questions from the study, as well as use the information obtained, along with the literature review to make suggestions if another school was making the same transition.

Chapter Five: Recommendations and Discussion

Overview

The purpose of this study was to investigate the transition process when moving from a spiral science curriculum to a field-focus science curriculum in the middle schools in the New Heart School District. A spiral-science curriculum teaches a small part of each field of science (or a little of each strand of grade level expectations) each year, so that achievement of all strands of grade level expectations are complete by the end of the 8th grade year. A field-focus science curriculum concentrates on specific fields (or strands of grade level expectations) each year, so that again all strands of grade level expectations are complete by the end of the 8th grade year. The theory behind the field-focus alignment is that less time is spent reviewing previous knowledge, because the topics build on each other, allowing for deeper learning to take place. The following questions guided the investigation:

Question 1: What process did my district, and surrounding districts utilize when making a transition to a new curriculum alignment in middle school science?

Question 2: What challenges was my district, and surrounding districts faced with when making the transition to a new science curriculum alignment?

Question 3: How do teachers perceive the transition process, specifically the related professional development in my district?

Question 4**:** What recommendation of strategies for middle school science does the state of Missouri give?

Question 5: How do the curriculum materials and teacher resources support the grade level expectations mandated by the Department of Elementary and Secondary Education?

The final chapter will answer these questions, as well as draw a conclusion about the investigation in the transition to a field-focus science curriculum at the middle school level. The chapter will compare the suggestions made by literature in the change process, to that of the change process taken on by the New Heart School District during the transition process. Included in this chapter are suggestions for middle schools making transitions to new science curriculum alignment in the future. The last portion of the chapter gives suggestions for future studies related to the investigation.

Question 1

What process did my district, and surrounding districts utilize when making a transition to a new curriculum alignment in middle school science?

Transitions in schools, just like in businesses, can be difficult. Deciding the process a district goes through when making a transition can determine the success of the transition. My district, as well as others, had data to support the transition to a field-focus science curriculum alignment. One district explained that a spiral curriculum alignment sounded like a positive idea, but often leads to skimming the information which is not at the level of rigor needed to succeed on the standardized test. All districts shared the data to support the transition with their teachers. Showing the data is fundamental in helping teachers understand why the change is necessary.

All district science coordinators who were interviewed shared the importance of communication with the teachers of the district. Keeping everyone updated and being available to answer questions alleviates some of the worries that come with change. One district holds monthly meetings to keep middle school science teachers updated on the information, where the other districts stated that communication was important, but did not have a specific way of communicating. Much of the communication process, as far as meetings are concerned, is something specified by the district calendar and mandates. After the start of the year, the only other mandated district science department meeting is on the day back from winter break. Any other meeting opportunities are voluntary. This leads to communication primarily via e-mail.

The information gathered from the district coordinators related that the teachers took part in professional development to begin the transition process and an opportunity to work with the materials. All districts provided the teachers will materials from specific curriculum companies as determined by the choice of the district. The districts stated the ability to supplement material was acceptable when provided materials were insufficient at covering the grade level expectations. Providing the necessary material helps to alleviate some of the tension when transition to a new curriculum alignment.

The district that has had the field-focus curriculum in place the longest, explained how the science department was very strong. The coordinator said the strength had sustained itself through the achievement of the students on the MAP test. The district had some of the highest eighth grade science MAP scores in the state of Missouri. The coordinator explained how this helped build a strong bond between the teachers and working together to keep improving. The district celebrated the success of the students

and teachers on the MAP test. The other two districts interviewed were new to the transition process, which had not allowed ample time to see results on the MAP test.

The same district with high MAP scores used the positive feelings from the high scores to push them to achieving in other areas as well. The district had students participating in the Science Olympiad at the national level. This is a major accomplishment for a middle school. The district set the standards high expecting success each year.

Although each district had their own unique characteristics, the processes districts go through are similar when transitioning to a field focus curriculum. The district that had sustained a field-focus alignment for the longest amount of time definitely showed more confidence in the success of the transition process, rightly so, since their MAP results prove the accomplishment. That district also has made it through the entire transition process. The actual decision of making the transition to a field-focus science curriculum came at different paces, but the actual transition steps were similar. No matter where the district is located, the initial transition process to a field-focus science curriculum alignment is nearly the same.

Question 2

What challenges was my district, and surrounding districts faced with when making the transition to a new science curriculum alignment?

The largest challenge presented in the district was the unsure outcomes of the change process. Teachers, as do most people, do not necessarily like change. Getting the teachers to look past their comfort zones and into the future is a challenge that when any change comes about and a change as large as the alignment of curriculum is even more

cumbersome. Working to get all teachers on the same page was the first challenge that districts come across.

Secondly, the districts alluded to another hurdle as the sharing of materials. During the change process, the different grade levels transitioned to new units to teach, and the shuffling of materials was necessary for teachers to have the materials needed for the units. A smooth process to ensure that materials are where they need to be the teachers need them is essential. The districts created pacing guides to help insure ample time for grade levels to share materials.

My district science coordinator stated one of the greatest challenges was the amount of time over which the transition took place over. The making of the decision to change was on the first day of teacher professional development in 2009. School started the following week and the group would not meet back again until January 2010. The calendar made a profound impact on how quickly the group had to transition. When completing a transition under time restraints, there is a possibility of missing key components of the change process.

With the lack of professional development days spread throughout the school year communication amongst teachers was weak in the New Heart School District. Teachers would tend to talk with the teachers at their school and primarily at their grade level. Communication with other schools would only take place via e-mail and only if initiated by a teacher. Even talking within the school amongst grade levels was tough due to planning times did not overlap.

The last challenge that influenced the districts was simply the learning curve that a change in any form would present. When implementing a field-focus curriculum

teachers are learning new material for most of the year, causing some lessons to have weak areas. As a teacher I know once I have taught objectives multiple times the comfort level grows and effective teaching increases. Providing extra support during the learning curves allows teachers to feel more comfortable.

Any time a change is occurring there are going to be challenges that arise. Knowing how to work through the challenges is what can lead to the success of the transition. The size of the district can affect the work the coordinator has to endure to make a smooth transition. With the New Heart School district serving nearly 20,000 students the science coordinator oversees the science curriculum throughout the school district. This is a tough task and makes it difficult to communicate. On the other hand, smaller, rural districts might not have a science coordinator and depend on a head science teacher or department head to take the responsibility of implementing the science curriculum.

Question 3

How do teachers perceive the transition process, specifically the related professional development in my district?

Professional development is essential when implementing an innovation in a school. Professional development allows teachers to learn how the implementation of the practice into the classroom looks and provides them with the necessary information to make the transition to the new concept a positive one. My district has two professional development days strictly focused on content related material at the beginning of the year. At the start of the 2009-2010 school year, the two days of professional development for the middle school science department focused on transitioning to a field-

focus science curriculum alignment. The district coordinator was in charge of both of the professional development days.

A leader wants teachers to feel positive about the professional development provided to them. Twenty middle school science teachers completed a perception survey regarding the professional development provided to them during the 2009-2010 school year, the initial year of implementation of the transition to a field-focus alignment. The results were not positive. Although the majority of teachers agreed the transition to a field-focus curriculum benefited the students' learning, they felt that the professional development to transition was insufficient.

Doug Reeves (2010), a leading presenter on the importance of professional development, explains the importance of professional development, as removing oneself from the problem. If the teacher does not understand the purpose of the implementation then he/she is part of the problem. It is up to the leader to provide the professional development necessary to move the teachers into a full understanding of the implementation process of the innovation.

In the case of a transition to a field-focus science curriculum alignment, a teacher must see how the topics build on each other. The leader needs to provide the professional development to show teachers how the topics intertwine within each other and build on the previous topic. Moving from teaching subject matters of science to teaching concepts of science helps the ideas to build upon each other. Providing sufficient professional development to present the concept driven instruction is a key factor into transitioning to a field-focus science curriculum.

The importance of follow-through on professional development was emphasized by the perception survey. The survey showed that teachers felt there was a lack of follow-through, the five month lapse between meetings being one example. Follow-through provides guidance to the teachers, providing them with help when needed, for example if a teacher is struggling with the material or implementation of the kits into the classroom. The science coordinator needs to develop a system of checking-in with the teachers, so he or she can support the teachers in their needs. Continuous support to the teachers provides opportunities for leaders to assist with any weaknesses of teachers, and provide them with further professional development opportunities. Districts have budgeted professional development money each year and there are workshops that provide opportunities for teachers to improve their knowledge and skills. In some instances, there is money set aside for substitute teachers, so teachers can participate in district professional development, whether it is observing another teacher using best practices or working with the coordinator directly on ways to best implement the material.

Professional development is a crucial factor in making a transition to a new idea. It is important for the coordinator to lay out the necessary professional development so that teachers move into the innovation with a clear understanding of what is to take place. The coordinator should schedule a professional in the area of concern for the professional development days and use a end of day survey to determine if further professional development is necessary. Of equal importance is the follow-through professional development, so teachers can continue to further their understanding. The coordinator should observe classrooms and have an open communication with teachers regarding the

strengths and weaknesses in the classroom. Teachers could participate in peer professional development where teachers observe each other and notice the best practices. Professional development is a key factor for the success of a new innovation.

Question 4

What recommendation of strategies for middle school science does the state of Missouri give?

Although the state of Missouri cannot directly require the districts to align their curriculum in any certain way, it is possible for them to acquire some guidance. The educational science consultant for the Missouri Department of Elementary and Secondary Education can help districts look at the curriculum and materials it has in place and ask questions for districts to answer to help guide them in a new direction. No two districts are the same, so mandating alignment would not be a positive task for the state to overtake. For this reason, the state simply offers guidance given by the consultant. The New Heart School district used the consultant's advice to decide to make the transition to a field-focus science curriculum.

Districts throughout the state are beginning to favor a field-focus curriculum at the middle school level. The change from a spiral curriculum comes with possible implementation of end of course exams in middle school science. Changing to field-focus curriculum allows teachers to raise the students' depth of knowledge to a higher level by permitting the teacher to concentrate on concepts covered throughout specific fields of science. Going deeper into content and concepts allows for greater understanding by the students, leading toward better retention of information.

Question 5

How do the curriculum materials and teacher resources support the grade level expectations mandated by the Department of Elementary and Secondary Education?

The grade level expectations, determined by the state, establish what teachers should cover in their classes. The districts make the judgment on what materials to use to support the grade level expectations. The three districts I interviewed each had different materials they used to lead the instruction. Each district did mention that the number one priority was coverage of the mandated grade level expectations, and if the provided materials did not cover the information, adequately, the teachers had the capability to supplement where they felt necessary. Which district placement of the teacher depended on whether funding of outside resources was by the district or by the teacher themselves.

Giving the teachers the ability to supplement materials is necessary to insure teachers cover all the required information. Since curriculum companies sell products nationwide, and the state mandates the grade level expectations, the curriculum companies will generally have small gaps teachers have to fill. Allowing the implementation of supplemental material into the classroom provides the opportunity for all information to be covered.

Conclusion of Investigation

A field-focus science curriculum alignment allows teachers to instruct deeper into concepts covered in science. Moving deeper into concepts allows students to draw greater connections between related topics. When topics interconnect in the brain, students categorize the information and store it for long-term memory (Jensen, 2008). When concepts become part of the long-term memory, students can connect the

information to future topics and apply it for future use. Moving towards a field-focus curriculum alignment moves districts in a positive direction for greater results on the standardized test.

Once a district has indicated the movement towards a field-focus science curriculum alignment, the coordinator needs to have data to support the change. Making transitions from what teachers are comfortable teaching shift, so to show the need for change a leader needs to show the reasoning behind innovation. Supporting the decision with data and physically presenting the data to the teachers will help gain buy-in from the teachers and other stakeholders involved.

Once a leader has buy-in from 100% of the teachers, it is necessary to develop a vision together and determine the steps necessary to move in the desired direction. Determining the steps to move toward the vision should include a specified and specific professional development plan. The professional development plan should include details of when events will happen to prepare the teachers. With teachers instructing different fields of study, differentiated professional development will be necessary. Working with teachers on an individual basis and differentiating their professional development to meet their needs will help make the transition move smoother as well as faster.

Understanding the importance of the professional development leads into the pace of the transition. To provide more individualized attention to the teachers, it is beneficial to transition over a three-year period, truly focusing on the teachers at the specific grade-levels of focus for that year. For example, the first year the sixth grade teachers would realign their curriculum to cover all standards under their specific field. During this year,

the coordinator could focus solely on the sixth grade teachers. The second year the field-focus curriculum alignment would transition into the seventh grade classes; this is when seventh grade teachers would have more provided guidance and specific focused professional development. Finally, the third year of the transition process the field-focus alignment would cover all of the middle school and eighth grade teachers would receive individualized professional development. Teachers from the previous year transition could help guide the teachers through the process. Although transitioning over a three-year span seems like a slow process, the gains from specified professional development will overshadow the lengthy progression.

District coordinators, supporting administrators, and teachers determine the order of the science fields covered in the middle school curriculum. Coordinators have a variety of data points to consider when making the decision. It is necessary to look at the difficulty of the topics. The topics that are more concrete, such as life science, are better for the youngest level due to the way the younger brains retain information. As students get older, they can understand and retain information that is more abstract, which would cause for a science field that is more abstract, such as Earth Science. Knowing that the standardized test is given in late March to early April means that all information needs to be covered by the time the test comes about. When looking at the grade level expectations, Earth Science has the least number of benchmarks to cover, meaning that logically eighth grade is a good place, so that coverage of all benchmarks is probable prior to the state test. Based on the discussion with the district coordinators, as well as the state science educational consultant the suggested order is:

Table 6

Suggested Order of Fields

Grade Level	Field Taught
Sixth Grade	Life Science
Seventh Grade	Physical Science
Eighth Grade	Earth Science

The science leaders of the district, in conjunction with building principals, can place teachers at specific grade levels based on their strengths of the fields. It would be beneficial to insure that teachers start with a topic they have covered previously. Another important factor is instituting the inquiry strand throughout all grade levels. Although the transition time is challenging, making the change with data to support the need for change, can help turn a struggling district in the right direction.

Change for the Best

Research shows that teaching toward specific concepts, instead of specific topics, is the best way to design a science curriculum (Olson, 2008). Teaching in a concept focus science allows students to retain the most information possible. Obviously the goal as an educator is to help students learn and retain the most information possible, to help them be able to apply their knowledge to future problems. It is necessary for curriculum to align in a flowing and building format if concept teaching is going to take place.

To implement any type of curriculum to the fullest potential there must be professional development present. The district will need to implement professional development that focuses on finding the big ideas and looking at the concepts that fall

around the big ideas. Teachers need to work together to develop the big ideas and concepts, as well as use a pacing guide that determines the order of the concepts to focus on and build upon. At the beginning of the year, the middle school science teachers will have three days of working together, which would be a perfect time to implement the professional development about finding the big ideas and developing the concept focus teaching process. Working together toward the same goal is necessary for success to come from the realignment of the curriculum.

Suggestions for Future Studies

A future study would be to evaluate the field-focus curriculum. This study would evaluate if a field-focus curriculum alignment would lead to better results on the MAP test. Although interesting, limitations would consist of district demographics, curriculum used, professional development offered, as well as instructional strategies used. The other limitation is a district would have implemented a field-focus curriculum alignment for at minimum a three-year span prior to conducting the study. A large sample would be needed for such a study, and as the state tests transition to different formats such as end of course exams, this may be difficult.

Another possible study could evaluate the student perception on a field-focus science curriculum alignment. A researcher could examine student perceptions of retention of information during a field-focus science curriculum. The study could also look at growth on common assessment data to determine if students are retaining information for longer amounts of time. Additionally, a researcher could study students' interest in science to see if one type of alignment is more appealing to students.

Additional studies could include observations in middle school science classrooms or other student achievement data beyond state standardized tests. While this study only focused on middle school, it could be replicated in a high school or elementary setting if a similar transition was taking place.

Recommendation for Transitioning to Field-Focus Science Curriculum Alignment

Change is difficult, but when a leader follows a process that is clearly developed, change becomes less stressful. I would use the steps suggested by Kotter (1996) when moving through a change process. When reviewing the researched based information of several different studies, Kotter's (1996) article on *Leading Change,* truly had the big picture of the parts of the change process. The other studies would consist of part of the change process, but none was broken down into easy to understand steps as Kotter's (1996). The following guidelines gives suggestions for transitioning to a field-focus science curriculum, but could be applied in nearly all transition situations. The examples provided are for each step if I were to lead a transition process to a field-focus science curriculum alignment, based on the data gathered for this study and my own experiences as a science teacher during the transition.

Step 1: Create an Urgency for Change

For people to change, they need to see the reason why the change is necessary. If there is a sense of urgency for the necessity for change, then the buy-in is greater (Kotter, 1996). The leader guiding the change needs to present the teachers with data that supports the need for change, whether the data is weak MAP scores or an increase in surrounding districts MAP scores, or some other form. Providing gaps in data help to support the urgency, but this is often one of the toughest challenges (Burge, 2008).

Another way to show urgency is providing the stakeholders with information concerning the outcome if the change does not take place.

Example:

If I were a district leader, I would approach my teachers with clear-cut data, supported in a graph format that shows the school's weaknesses.

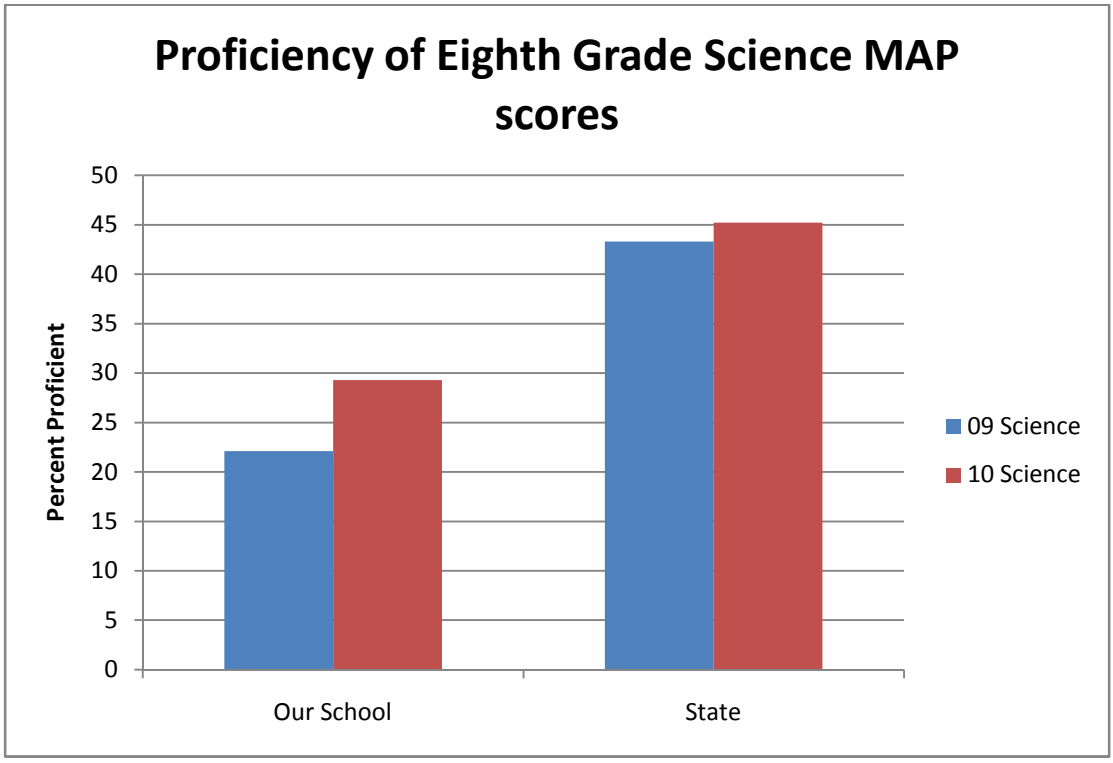

Figure 8: **Example of a Graph.**

I would let them analyze the graph and guide them to understand the importance of the need to make improvements together. The graph shows the gap that the district has when compared to the state. Through the eyes of the teacher, it would show a need for change now.

Step 2: Develop a Partnership

A leader should create a collaborative working environment. The partners should work together in a positive community. In a positive partnership, everyone has a voice in what is fabricating. It is necessary for all stakeholders involved to have the ability to share ideas and know the progress of the transition (Burge, 2008). Working together to create a positive environment helps to have everyone buy in on the change process.

Example:

After showing the urgency, as a leader, I would have everyone write ideas on post-it notes concerning how we can change our data. I would present the teachers with data from areas making gains in their MAP scores, which would represent a field-focus alignment. At this time, I would ask the teachers for ideas to implement within the district. I would create a situation where all have a voice. Once I present the idea of a field-focus curriculum, I would ask the teachers to write their thoughts on a post-it note regarding how they feel about their curriculum alignment, also encouraging any suggestions they might have. We would go through the post-it notes together and determine the direction the district will head. At this time, the leader would need to analyze if more information needs provided to gain full support from the teachers. If all teachers are on board with the transition, it is time to move through the next step of the change process.

Step 3: Creating a Vision

A common vision allows everyone to be working toward the same goal. The vision gives a guidance of what a group is working toward, and if focused on fully, everything done within the group should be in conjunction with the vision. Once a clear vision is determined, the group should develop an action plan to reach the vision (Kotter,

1996). The action plan provides the steps necessary to take to make a smooth transition to a field-focus science curriculum. It is necessary that everyone agrees and buys-into the vision and action plan.

Example:

As a leader, I would once again work together to strengthen the partnership and create a shared vision. I would let everyone come up with a vision on his or her own, then collaborate in a small group and share. The collaborative groups would work together to take the strongest pieces of each vision and combine them together. I would then do the same step where each group shares their vision and as a collaborative team, we would develop a common vision. I would also present the vision as the target point for every aspect provided from that point forward. It is extremely important to keep the vision in mind throughout the transition.

Once the vision is determined, I would work with the group to develop an action plan. It is necessary for the teachers to take part in developing the action plan, since they know best what items are necessary to have in place for the smoothest possible transition. Having the action plan developed together and clear deadlines for implementation, helps for all stakeholders to be on the same page. Collaboration amongst all stakeholders to develop the action plan helps to reach the common vision.

Step 4: Communication

Developing a communication system where all stakeholders know what is happening have an outlet to ask clarifying questions, and can find help when needed, is a key feature in the success of an innovation. A leader in an organization needs to create an effective communication tool or system that all stakeholders use during the transition

process (Burge, 2008). When transitioning to a new curriculum alignment it is necessary for everyone to be on the same page, so the sharing of supplies takes place at the appropriate times and teachers cover of all necessary materials determined for their grade level. When a transition occurs, it is necessary for teachers to communicate when the time will come to exchange supplies, so they must cover specific content at specific times.

Example:

As a leader, I would develop a pacing guide for each grade level and have it posted on a shared calendar for all teachers to view. On this calendar site, I would also provide a blog spot for teachers to communicate amongst each other. I, daily, would monitor the blog site, because I would encourage teachers to post any questions or comments to me as well. During a transition time, there is not much time for teachers to figure out problems on their own, so it is necessary for them to work together. Providing them a common communication ground allows for easier correspondence.

Step 5: Provide

Change is difficult for many stakeholders, because it removes them from their comfort zone. A way to ease the transition is to provide the necessary materials for the transition to take place (Kotter, 1996). If a teacher is, missing part of the items to complete the unit, during a time of transition it should be up to the leader to help find the items and deliver. During a transition process, teachers have enough new challenges that await them, that looking for necessary materials should not be one of the challenges (Kotter, 1996). On the other hand, if a teacher expresses an area of concern, then it is

necessary to provide him or her with the professional development to make them feel comfortable in the classroom.

Example:

As a leader, I would use the existing blog site for the teachers to post questions or comments about their needs. I would also provide weekly e-mails and communication items that keep them up to speed on the transition process. I would also check with the teachers at least once a week to make sure they have all necessary supplies. Providing the open door policy to the teachers allows them to feel like they can let me know if they are in need of anything. I would also take the time to observe the teachers and give the constructive feedback on the instruction. The post-conference would provide an opportune time for the teachers to communicate with me and let me know what they need.

Step 6: Celebrate

A vision is a long-term goal, but it is necessary to celebrate the small milestones along the way to reaching the final goal. Celebrating along the way detours the process from seeming never-ending (Kotter, 1996). A transition to a new alignment is not going to happen overnight and create instant success, so it is necessary to celebrate the small steps leading to the final vision. The steps of the action plan provide possible celebration points. The vision is long-term, the action plan provides the small steps and reaching a new step is a cause for celebration.

Example:

Celebrating the little steps keeps the motivation high. As a leader, I would make a point to share any small successes that I view while completing my observations. I

would share the successes through a weekly e-mail, as well as leave personal notes for teachers during the observations. I would also look at common assessment data and use that to celebrate successes. Providing the names of the teachers is a nice way to show gratitude, but I think a nice personal card with a small gift will add an extra incentive. It is nice when a teacher is recognized, but taking a little personal time to write out a card shows an extra little touch to show the leader recognizes the accomplishment.

To show the gains made on the same site as the shared calendar I would develop a flow chart that demonstrates what step the group is on in the action plan. The flow chart is a good reminder of where the group is in the action plan, as well as a visual showing when the group has progressed to a new step, which is definitely a cause for celebration.

Step 7: Embrace Gains

A leader needs to recognize the gains made and embrace them. Showing how the gains are improving the students learning and supporting the gains with clear-cut data allows teachers to view the gains quickly and easily and embrace that they are moving in the right direction (Thomson, 2010). The gains show that the transition process is working and needs to keep moving. This would be a time to implement deeper professional development. It appears that the teachers are making strides, provide them with professional development to complete the whole vision.

Example:

Along with celebrating the gains, I would embrace them and show the teachers how the gains are leading us toward the vision. The flow chart is a visual to embrace the gains made. As a district, we would have common assessments focused on the GLEs, which teachers would give and report to me. I would then share the results and celebrate

the gains. The flow chart represents where our status is currently and how we can work together to make it to the vision. I would look at any areas of weaknesses and provide deeper professional development that aligns with the final vision. Furthering the professional development helps to keep the teachers' sights moving forward.

Step 8: Securing the Change

The change is what the group stands for. Completing the change successfully means reaching the common vision and goal. It means that the school is now achieving excellence in the area and it should make that well known. Moving through the transition toward the common vision is what the group now represents (Kotter, 1996). Everything put into action in the district should focus on the common vision.

Example:

During the transition process, it is necessary for all items taking place in the middle school science department to support the process to the new curriculum alignment. If items do not support the new field-focus curriculum alignment, then it detours the group away from the vision. Once the transition has taken place and we see the benefits of the transition of the field-focus curriculum alignment, the school will then focus that as a part of "who" we are. In my case, if I was the leader of the change process to a field-focus science curriculum alignment, once the entire transition took place, I would work with the district to change the name of the middle school science classes. Instead of using the term 'science' for each grade level just have science class, I would change the name of the class to the field it focuses on. For example, the students in eighth grade science classes would have Earth Science on the schedule. Changing the name simply keeps the focus on what the students are learning.

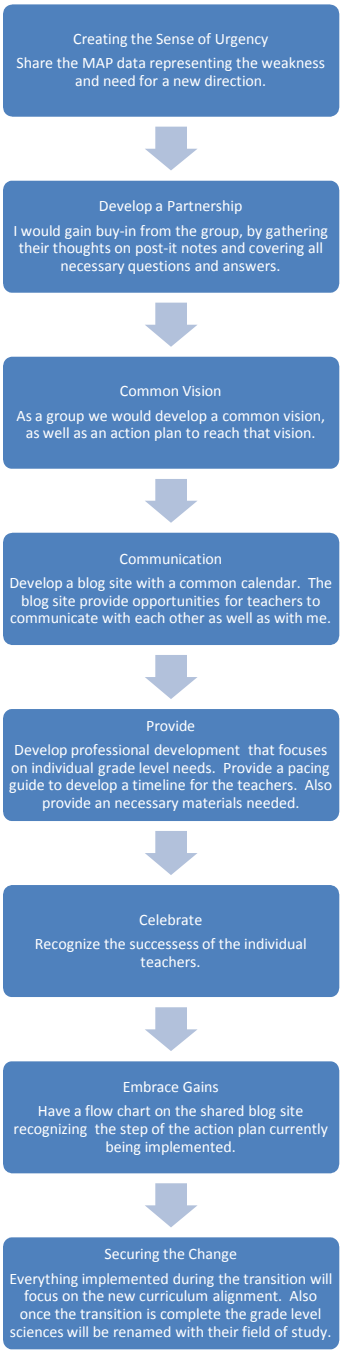

Figure 9: Applying the Eight-Step Process of Change to a Transition to a Field-focus Science Curriculum

Conclusion

The investigation into a transition between a spiral science curriculum alignment to a field-focus science curriculum alignment allows for districts across the country to

understand the steps that are necessary to move to a new alignment. Although my investigation focuses directly on the middle school science alignment, the transition steps, challenges, and suggestions are able to apply to any transition process. Although all transitions are tough, using the steps suggested by Kotter (1996), and explained in depth through the investigation, can help the process run smoothly.

My district, as well as any district, can look into my investigation and determine how what factors go into a transition process. The investigation can provide a foresight in presented challenges in the transition process. Anyone who reads the investigation process can look at the challenges and suggestions given by the coordinators and develop action plans to dodge the hurdles prior to them becoming present. Using the suggestions to a field-focus curriculum takes the challenges perceived into account and provides recommendations of specific items to incorporate allowing leaders to dodge the challenges.

Transitions are difficult for teachers. They are attempting to move in a new direction, while still providing the highest quality instruction to the students. If a leader uses the "Eight Steps to a Successful Change" outlined by Kotter (1996) and detailed by the researcher of this study, he or she could have a successful transition and support the teachers to the greatest degree. Making sure support is in place for all stakeholders is essential in making a smooth transition.

Appendices

Appendix A

Portion of Grade Level Expectations Set up for Spiral Science Curriculum (Department of Elementary and Secondary Education, 2010)

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	**Sixth**	**Seventh**	**Eighth**
C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification	*Scope and Sequence – Properties of and Changes in Matter* a. Describe evidence (e.g., diffusion of food coloring in water, light reflecting off of dust particles in the air, condensation of water vapor by increased pressure or decreased temperature) that supports the theory that matter is composed of small particles (atoms, molecules) that are in constant, random motion		*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Describe evidence (e.g., diffusion of colored material into clear material such as water; light reflecting off of dust particles in air; changes in physical properties and reactivity such as gold hammered into foil, oil spreading on the surface of water, decay of organic matter, condensation of water vapor by increased pressure) that supports the theory that matter is composed of moving particles too small to be seen (atoms, molecules
ST			
DOK	a. 2		a. 1

D. Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter	*Scope and Sequence – Earth's Resources* a. Describe the relationship between the change in the volume of water and changes in temperature as it relates to the properties of water (i.e., water expands and becomes less dense when frozen)	*Scope and Sequence – Weather and Climate* a. Describe the relationship between temperature and the movement of atmospheric gases (i.e., warm air rises due to expansion of the volume of gas, cool air sinks due to contraction of the volume of gas)	*Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Using the Kinetic Theory model, illustrate and account for the physical properties (i.e., shape, volume, malleability, viscosity) of a solid, liquid, or gas in terms of the arrangement and motion of molecules in a substance b. Use the Kinetic Theory model to explain changes in the volume, shape, and viscosity of materials in response to temperature changes during a phase change c. Predict the effect of energy transfer on the physical properties of a substance as it changes to or from a solid, liquid, or gas (i.e., phase changes that occur during freezing, melting, evaporation, boiling, condensation)

Appendix B

Portion of Grade Level Expectations adapted for a Field-focus Science Curriculum Alignment

1. Changes in properties and states of matter provide evidence of the atomic theory of matter			
Concept	**Sixth**	**Seventh**	**Eighth**
C. Properties of matter can be explained in terms of moving particles too small to be seen without tremendous magnification		*Scope and Sequence – Properties of and Changes in Matter* a. Describe evidence (e.g., diffusion of food coloring in water, light reflecting off of dust particles in the air, condensation of water vapor by increased pressure or decreased temperature) that supports the theory that matter is composed of small particles (atoms, molecules) that are in constant, random motion *Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Describe evidence (e.g., diffusion of colored material into clear material such as water; light reflecting off of dust particles in air; changes in physical properties and reactivity such as gold	

		hammered into foil, oil spreading on the surface of water, decay of organic matter, condensation of water vapor by increased pressure) that supports the theory that matter is composed of moving particles too small to be seen (atoms, molecules	
ST			
DOK		a. 2, a.1	a. 1
D. Physical changes in the state of matter that result from thermal changes can be explained by the Kinetic Theory of Matter		*Scope and Sequence – Weather and Climate* a. Describe the relationship between temperature and the movement of atmospheric gases (i.e., warm air rises due to expansion of the volume of gas, cool air sinks due to contraction of the volume of gas) *Scope and Sequence – Earth's Resources* a. Describe the relationship between	

		the change in the volume of water and changes in temperature as it relates to the properties of water (i.e., water expands and becomes less dense when frozen) *Scope and Sequence – Physical and Chemical Properties and Changes of Matter* a. Using the Kinetic Theory model, illustrate and account for the physical properties (i.e., shape, volume, malleability, viscosity) of a solid, liquid, or gas in terms of the arrangement and motion of molecules in a substance b. Use the Kinetic Theory model to explain changes in the volume, shape, and viscosity of materials in response to temperature changes during a phase change Predict the effect of energy transfer on the physical properties of a substance as it changes to or from a solid, liquid, or gas (i.e., phase changes that occur during freezing, melting, evaporation, boiling, condensation)	

Appendix C

Coordinator Interview Questions

1. How long have you been in the position at this school district?
2. How many middle school teachers do you support?
3. In your middle school, how is the science curriculum aligned and with what is the curriculum aligned (example: kits, textbooks, grade level expectations)? What topics are covered by which grade levels?
4. Why is it aligned in this way?
5. How long has the alignment been in place?
6. What were the logistics behind the change?
7. What support do you offer to your teachers to aid in the curriculum transition?
8. List the curriculum company and supply companies that are used?
9. Once order per grade level is determined, how is the order of the specific topics determined per grade level?
10. What type of professional development that has been offered, both required and voluntary? How would you evaluate how the implementation of the professional development went?
11. Do you have suggestions for what you would have changed for the professional development?
12. List the top three strengths of the science alignment.
13. List the three largest hurdles you have encountered during the transition process.
14. What trends have you seen in MAP (Missouri Assessment Program) science data since the implementation of the field focus science curriculum?
15. Aside from MAP, is there any other common assessment that your district gathers data on that pertains to science?
16. Are there any overall data analysis of common assessments that you are willing to share to help further my research?
17. List any advice you would give a coordinator in another district that is considering making the transition to a field focus alignment.

Appendix D

Educational Consultant of Science for the Department of Elementary and Secondary Education

1. What is your background? (credentials, teaching experience, etc.)
2. What is your role as the president?
3. How do you feel curriculum should be aligned at the middle school level?
4. What professional development is available through STOM that looks into curriculum alignment?
5. If a school district is looking to change their alignment of curriculum in science, what are your suggestions?
6. What steps are necessary when making a transition to a new curriculum?

Appendix E

Teacher Survey Questions

Investigating of the Transisition Process from Spiral Curriculum to Field Focus Curriculum

Exit this survey

1. Default Section

1. What grade level were you teaching during the initial implementation year of the transition to a field focus curriculum?

- 6th
- 7th
- 8th

2. The professional development provided at the beginning of the 2009-2010 school year was succifient for the process of moving to a field focus curriculum

- 1- Strongly Disagree
- 2- Disagree
- 3- Neutral
- 4- Agree

☐ 5- Strongly Agree

3. The follow-up professional development on the implementation of the field focus curriculum was sufficient.

☐ 1- Strongly Disagree

☐ 2- Disagree

☐ 3- Neutral

☐ 4- Agree

☐ 5- Strongly Agree

4. Sufficient guidance was provided throughout the school year to implement the field focus curriculum.

☐ 1- Strongly Disagree

☐ 2- Disagree

☐ 3- Neutral

☐ 4- Agree

☐ 5- Strongly Agree

5. The pace of moving to a field focus curriculum was at a pace that was easy to implement.

☐ 1- Strongly Disagree

☐ 2- Disagree

- 3- Neutral
- 4- Agree
- 5- Strongly Agree

6. The implementation of a field focus curriculum benefits the students since the topics build on each other.

- 1- Strongly Disagree
- 2- Disagree
- 3- Neutral
- 4- Agree
- 5- Strongly Agree

7. Looking back and focusing on the implementation of the curriculum, the primary transition year (2009-2010) to a field focus curriculum was a smooth year.

- 1- Strongly Disagree
- 2- Disagree
- 3- Neutral
- 4- Agree
- 5- Strongly Agree

8. If the transition process could start over, give three suggestions on what you would keep or what you would change.

9. What suggestions do you have to keep the transition process going?

10. What specific input did you have on the implementation of the transition process?

Done

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Vitae

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