UNDERSTANDING TEACHER USE OF INQUIRY: INVESTIGATING CATALYSTS AND BARRIERS

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UNDERSTANDING TEACHER USE OF INQUIRY:
INVESTIGATING CATALYSTS AND BARRIERS

Susan H. Guertin

BS Elementary Education, Western Connecticut State University, 1977
MS Reading Consultant, Western Connecticut State University, 1983

A Dissertation
Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Education in Instructional Leadership
in the
Department of Education and Educational Psychology
at
Western Connecticut State University
2013
The purpose of this qualitative, multiple-case study was to investigate the catalysts and barriers related to implementing inquiry-based instruction in elementary school from the perspective of third, fourth, and fifth grade teachers. The participants included five teachers who were frequent inquiry users, and four teachers who were infrequent inquiry users. The subjects were interviewed about their teaching styles and beliefs about education, understandings and use of inquiry-based learning, feelings about instructional change, personal experience with inquiry as students, problem-solving preferences, and opinions about the catalysts and barriers to teacher use of inquiry. Each subject was observed and rated on the level of inquiry use on a rubric designed to measure the quality and frequency of inquiry in their lessons. A short problem-solving styles instrument was administered to search for common patterns among teachers.

Triangulation by source (high frequency and low frequency inquiry teachers) and method (observations, interviews, and problem-solving styles assessment) established trustworthiness. The themes that emerged were classified into internal and external spheres of influence. The themes related to the internal sphere of influence were beliefs about educational change, direct instruction practices, student engagement, teacher emotions, teacher knowledge of instructional practices, teacher knowledge of inquiry practices, teacher pedagogical beliefs, teacher problem-solving style, and types of questions posed. The
external sphere of influence themes were age and years of teaching experience, collaboration, mandated educational change, mandated testing, parent feedback, peer pressure, professional development, program support, state standards, teacher experience with inquiry as students, and time constraints. The study found that these factors acted as catalysts and barriers to teacher use of inquiry in the classroom. The problem-solving styles instrument yielded no significant differences between the two groups of teachers, indicating that the teachers used their individual problem-solving styles to enhance their teaching in the classroom.
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APPROVAL PAGE

School of Professional Studies
Department of Education and Educational Psychology
Doctor of Education in Instructional Leadership

Doctor of Education Dissertation

UNDERSTANDING TEACHER USE OF INQUIRY: INVESTIGATING CATALYSTS
AND BARRIERS

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2013
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Earning a doctoral degree has been a life-long dream for me. I come from a family in which I was the first college graduate, and the first to earn a Master’s degree. My inspiration to achieve came from my mother, who valued education and had always regretted not attending college herself. She led me through my childhood reading, suggesting book after book. Her encouragement and support never wavered. She was my very first teacher, and I doubt that I would have been able to achieve success without her.

Even so, there are many others who contributed to the success of this dissertation project. Without the cooperation and help of the nine teachers who participated in this study, the completion of this dissertation would have been impossible. I am very grateful to them for their assistance. My colleagues at Hill and Plain School in New Milford have also been instrumental in my efforts to continuously improve and hone my craft. They cheered me on and pushed me to continue, even when it seemed too difficult. I am especially indebted to Robert Coppola, who showed me that inquiry education could change an entire community of learners. Together, we saved many students who had become discouraged and disengaged.

There is an entire group of people without whom I never would have been able to accomplish this project. They are Cohort Three at Western Connecticut State University. Our group supported, encouraged, and tutored each other, never letting anyone give up. The cohort model promoted collegiality and broadened my intellectual outlook. I have learned a great deal from working alongside these gifted people. I would particularly like to acknowledge my “mini-cohort,” Donna Baratta, who was also my reader, Stacy Ewings,
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My primary supporters throughout this process were the members of my family. My husband, Raoul, gallantly took over the duties of housecleaning and laundry to allow me the time to write this dissertation. My sons Ryan and Kevin used humor to encourage me to continue and complete this process. My youngest son, Colin, expressed his desire for me to complete the doctoral degree despite his own personal tragedy. My dog, Casey, spent hours
lying beside me as I worked, and Kitty sat in my lap as I typed, helping to alleviate the stress.

I am truly blessed to be part of this amazing family.
DEDICATION

This work is dedicated to

Raoul T. Guertin,
my loving husband,

the memory of
Barbara F. Halsey,
my mother and first teacher,

and
Casey and Kitty,
my dissertation dog and cat.

This project was a joint effort in so many ways. It would never have been accomplished without these family members.
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American students are quickly falling behind their international peers in their ability to think critically and solve problems (Darling-Hammond, 2007). On the Program for International Student Assessment (PISA, Hopstock, Pelczar, & Xie, 2011), a measurement that assesses higher-order thinking skills in 15 year-old students (e.g., application of knowledge to real-life problems), the United States (US) ranked 19th out of 40 countries in reading achievement, 20th out of 40 in science, and 28th out of 40 in mathematics achievement (Darling-Hammond, 2007; Fleischman, Hopstock, Pelczar, & Shelley, 2010). Although the United States has never scored at the top of the PISA results, reading scores for American students decreased between 2000 and 2003, while those from countries already out-performing the US, such as Finland, Korea, and Canada, increased. In mathematics, scores from US students did not change between 2003 and 2006, but those from Latvia, Hungary, and Poland increased to out-perform the total scores of students in the US (Provasnik, Gonzales, & Miller, 2009). For the US to remain competitive as a world leader in the 21st Century, teachers in the United States must use the most effective pedagogical methods available to develop students’ critical thinking, creativity, and ability to work in collaboration to solve currently unknown, complex problems in the future.

One instructional method that is known to draw on higher-order thinking and 21st Century Skills is inquiry-based learning (Brown, 2006; see Appendix A for alignment between inquiry and 21st Century Skills). The National Research Council (NRC, 1996) defines inquiry-based learning as a student-centered instructional methodology that involves
posing questions, making observations, consulting books and other sources for information, planning investigations, suggesting answers, and presenting the results to an appropriate audience. These activities encourage critical thinking, which leads students to deeper understandings of content (Aulls & Shore, 2008; Shore, Birlean, Walker, Ritchie, LaBanca, & Aulls, 2009). In the process, the students grow into independent learners (Thomas & Oldfather, 1996). Students who are active learners acquire knowledge and understanding better than students who are involved in more passive learning, such as lecture (Gibbs & Coffey, 1992). Inquiry, as a form of active learning, motivates students and personally engages them in their own learning (Drake & Long, 2009; Hu, Kuh, & Li, 2008; Jarvela, Veermans, & Leinonen, 2008; Palmer, 2009).

An example of the recognized importance of inquiry-based learning is the Common Core State Standards, the Connecticut State Department of Education’s newly adopted set of teaching standards (2010). This set of performance standards for teaching provides explicit expectations that active learning and inquiry across disciplines is not only encouraged, but required. The Connecticut State Department of Education (CSDE) website provides a Scientific Inquiry Formative Assessment Rubric (2011) for third- through eighth-grade students, rating their ability to make observations, pose questions, design investigations to answer scientific questions, display and work with data, and communicate evidence-based conclusions. Connecticut teachers must make inquiry part of their teaching repertoire as they prepare students for the 21st Century.

Despite the recognition inquiry receives as an effective teaching style, many teachers do not choose it as an instructional method (Makar, 2007; Marshall, Horton, Igo, & Switzer, 2007). Catalysts for using inquiry and barriers that preclude its use must be identified to help
teachers better prepare students for life in the 21st Century. This study explored teachers’ perceptions, beliefs, and experiences in teaching to discover themes that emerged as catalysts and barriers to use of inquiry in the classroom. The teachers’ understandings of inquiry, and their attitudes toward instructional change, were examined to uncover potential motives for avoidance or use of inquiry. The teachers’ preferred problem-solving styles were investigated to discover whether one’s approach to solving problems could influence pedagogical style.

**Rationale**

The investigation into catalysts and barriers to inquiry teaching is vital to broadening teacher use, which is important because inquiry learning is an excellent way to purposefully and actively involve students in their own acquisition of knowledge (Drake & Long, 2009; Hu, et al. 2008; Jarvela, et al., 2008; Palmer, 2009). As adults, the students of today will be living and working in a world that we can only imagine, doing jobs that do not exist today (Darling-Hammond, 2007). They will need to know how to find and synthesize information, problem-find, and problem-solve. To be competitive in an ever-changing world, students must be taught these vital abilities, and inquiry can provide the means of acquiring those skills. Inquiry incorporates many 21st Century Skills, such as creativity, innovation, critical thinking, problem-solving, communication, and collaboration (Brown, 2006), which are crucial to the future success of today’s students. US students must be better prepared for the economy in which they will find themselves as adults, or else available jobs will continue to be out-sourced to countries such as India and China (Darling-Hammond, 2007).

Inquiry inspires learning at a deeper level, and students retain information they have learned through the process for longer periods of time (NRC, 2000). Inquiry-based learning
also teaches students how to answer questions independently, which will be an essential skill in the future. Teachers have the potential to change the learning environment for all students through inquiry-based teaching, consequently decreasing lack of motivation and improving student outcomes by preparing them for the 21st Century (Drake & Long, 2009; Hu, et al., 2008; Jarvela, et al., 2008; Palmer, 2009). Moreover, teacher quality and evaluation will soon be tied to student performance (Fuhrman, 2010); therefore teachers should want to use the most effective instructional methods available.

There are few studies that have examined the underlying reasons teachers choose or avoid inquiry as an instructional method in their classrooms. Many of the existing studies pertained to teachers in countries outside of the United States, such as Finland, Jordan, Turkey, and New Zealand, where inquiry implementation is required by the national education systems (Byman, Krokfors, Toom, Maaranen, Jyrhama, Kynaslahti, & Kansanen, 2008; Qablan, Al-Ruz, Theodora, & Al-Momani, 2008; Spronken-Smith & Harland, 2009). However, even in countries that expected their instructors to utilize inquiry methods, there was teacher discomfort, uncertainty, and a lack of vision as to how to execute it in the classroom. Many of these teachers expressed lack of self-efficacy in inquiry implementation and were resistant to its use, even though they acknowledged the potential benefits to student learning (Qablan, et al., 2008; Spronken-Smith & Harland, 2009).

Much of the present inquiry-related research investigates student-teachers who experienced inquiry learning in college (Byman, et al., 2008; Gilbert, 2009; Malone, 2008; Qablan, et al., 2008; Sanger, 2008; Spronken-Smith & Harland, 2009). There were limited studies that have been conducted with experienced teachers who have been teaching for five or more years. Also, many studies concerning any kind of inquiry primarily investigated
middle school to college-aged students and their teachers, mostly in the area of science (Gilbert, 2009; Hu, et al., 2008; Mohamed, 2008; Sanger, 2008; Shore, Aulls, & Delcourt, 2007; Spronken-Smith & Harland, 2009).

In this research study, the participating teachers were asked about their personal experiences with inquiry when they were students in an effort to discover if this prior experience influenced the teachers to choose inquiry methods for their own students. There is evidence that teachers model their teaching behavior after their own teachers (Kennedy, 1991). Studies on learning styles by Dunn & Dunn (1979) found that teachers may also teach the way that they learn, because they believe it is the best way. In either case, the teachers who learned through inquiry were also taught through inquiry, thus they had a model to follow. The teachers were also asked to identify catalysts and barriers to inquiry use to provide insight about how to help teachers embrace and implement it to enhance students’ critical thinking and problem-solving skills. Finally, inquiry is closely connected to problem-finding and problem-solving (NRC, 1996, 2000); therefore the teachers were administered a problem-solving styles inventory to determine whether problem-solving preferences were related to teacher use of inquiry.

This current research study adds to the body of knowledge about teachers’ decision-making related to the use of inquiry as an instructional practice and offers an in-depth analysis of elementary school teachers through an examination of teachers’ beliefs regarding teaching style and education, their attitudes about instructional change, and their understanding of and experience using inquiry learning and implementation. To collect this information, two groups of teachers were recruited to participate in this study. One group consisted of frequent inquiry-use teachers, and the other consisted of infrequent inquiry-use
teachers. The teachers who used inquiry often were purposefully chosen to provide insight from the perspective of educators already implementing inquiry in the classroom. The teachers who utilized inquiry less often were chosen to offer their thoughts about why they were not presently implementing inquiry in their classrooms.

**Statement of the Problem**

Many American teachers avoid implementing inquiry learning (Makar, 2007; Marshall, et. al, 2007). This is problematic because students in the US are not consistently taught to utilize inquiry methods when searching for answers to a problem, which is a skill they will need as contributing citizens in the future. If the nature of careers in the future is presently unknown (Darling-Hammond, 2007), students will need to be able to adapt, find information quickly, and anticipate problems. Because inquiry leads to deeper student thinking and understanding (NRC, 2000), and teaches important 21st Century Skills (Brown, 2006; Darling-Hammond, 2007), it will be crucial for students to know how to use it to enhance the evolution of their professions and to compete in the global economy. Therefore, this study endeavored to provide insight into possible explanations of why some teachers choose to implement inquiry frequently, while others do not, and to propose feasible actions that may encourage more frequent implementation of this effective method.

**Potential Benefits of the Research**

Knowing the catalysts for elementary school teacher use of inquiry methods contributes important data to help teachers implement inquiry with more frequency to better align instruction with the skills and knowledge required for success in the 21st Century. In the same way, comprehension of the barriers that prevent elementary school teachers from
experimenting with inquiry illuminates ways to remove obstacles and provide adequate support.

Because most of the research studies on inquiry learning concerned science, the purpose of this study was to focus on inquiry in any content area and was not limited to science classes. There were few studies related to elementary school teachers, thus this investigation adds to the knowledge about how this particular group of teachers viewed inquiry learning, and what they perceived to be the catalysts and barriers pertaining to its use. This research study was able to provide several important insights that could lead to ways to increase teacher inquiry implementation. Information from these findings should assist educators in instituting catalysts and mitigating barriers to teacher use of inquiry, and encourage teacher willingness to employ this productive instructional method.

**Definition of Key Terms**

The following terms are relevant to this research study:

1. A *barrier* is a factor that obstructs teachers from using inquiry (Encarta English Dictionary, 2010).
2. A *catalyst* is a factor that causes teachers to use inquiry (Encarta English Dictionary, 2010).
3. *Change* is a process that causes alterations in what exists, and should always be seen as connected with “the particular values, goals, and outcomes it serves” (Fullan, 2001, p. 9).
4. *Continuum of inquiry* is defined along a range of three levels for the purposes of this study (Martin-Hansen, 2002). *Open inquiry* is a “student-centered approach that begins with a student’s question, followed by the student
designing and conducting an investigation or experiment and communicating results” (Martin-Hansen, 2002, p. 35). Guided inquiry involves more teacher support than open inquiry. The teacher often poses the question and students “assist the teacher with deciding how to proceed with the investigation” (Martin-Hansen, p. 35). Structured inquiry, also known as directed inquiry, is directed by the teacher. The “students follow teacher directions to come up with a specified end point or product” (Martin-Hansen, 2002, p. 37).

5. *External sphere of influence*, a term adopted from politics and economics, refers to factors outside of the teachers’ control, such as high stakes testing and mandated changes (Encyclopedia Britannica, 2012; Levine, 1972; Page, 1994).

6. *Inquiry* is defined as “learning by questioning and investigation; the questions asked and means for investigation are vast, nonlinear, and idiosyncratic. Inquiry encompasses diverse ways to study phenomena in all subject areas through dialogue, asking questions, and proposing explanations based on empirical evidence (NRC, 1996). A requirement of inquiry is that the goal of learning is ‘to do’ and learn ‘about’ at the same time. Inquiry requires imaginative, evidence-based explanations achieved through critical thinking and a deep understanding of concepts” (Shore, Birlean, Walker, Ritchie, LaBanca, & Aulls, 2009, p. 141).

7. *Internal sphere of influence*, a term adopted from politics and economics, is defined as factors over which teachers have personal control, such as teaching
style and personal belief systems (Encyclopedia Britannica, 2012; Levine, 1972; Page, 1994).

8. *Problem-solving style* is “consistent individual differences in the ways people prefer to plan and carry out generating and focusing activities, in order to gain clarity, produce ideas, and prepare for action” and is “influenced in part by mindset, willingness to engage in and respond to a situation as presented, and the attitudinal dimensions of one’s personality” (Selby, Treffinger, Isaksen, & Lauer; 2004, p. 222).

9. *21st Century Learning and Innovation Skills* are defined as creativity, innovation, critical thinking, problem-solving, communication, and collaboration (Johnson, 2009).

**Related Literature**

To create a context for this study, the review of literature is divided into five sections. The first section will briefly review the underlying theoretical constructs of the study. The remaining sections will review related bodies of literature that include teacher attitudes and beliefs about inquiry, teacher perception of instructional change, teacher personal experiences with inquiry, and problem-solving style as it relates to teacher effectiveness.

**Theoretical Constructs**

**Learning through constructivism.** The major underlying theoretical construct of this study is constructivism, which explains how students learn in terms of their ability and opportunity to observe, investigate, and construct meaning with the guidance of the teacher or mentor (Dewey, 1910; Vygotsky, 1978). Constructivism asserts that knowledge is created through social interaction and the context in which the students find themselves (Lee &
Smagorinsky, 2000). An example of constructivism was offered in John-Steiner and Meehan’s (2000) research that applied Vygotsky’s (1978) work about the zone of proximal development to explain how creativity is supported by social interaction such as that experienced in inquiry learning. They used the example of the musical composer Stravinsky, who composed his own pieces and then compared them to his master’s work to learn and improve his craft. Stravinsky depended on the tutelage of his master in the zone of proximal development to construct new meaning. Without the support of his master, Stravinsky most likely would not have been able to achieve beyond his own level of ability.

**Theory of planned behavior and teacher instructional choices.** Another theory underpinning this study is the theory of planned behavior. According to Ajzen and Fishbein’s 1980 theory, teachers’ beliefs and attitudes are the underlying qualities that influence how they decide to teach. Teachers’ beliefs about pedagogy and how students learn determine the educational techniques they choose to implement (Ajzen, 1988, 1991, 2001; Ajzen & Fishbein, 2008). If teachers believe that inquiry is too complex, they may resist implementation despite the evidence that it is effective. Inquiry has been described as “inherently difficult” (Meyer & Avery, 2010, p. 26), because the concept of inquiry is difficult to define. As a result, several definitions of inquiry exist (Aulls & Shore, 2008), complicating teachers’ efforts to understand and implement it in their practice. Also, even though teachers may know inquiry when they see it, it is difficult to implement when they lack the tools and the vision. Another difficulty is that inquiry may include the exploration of questions that do not have a pre-determined answer. Some teachers are not comfortable leading these types of discussions (Meyer & Avery, 2010).
Mindset: Teacher beliefs and instructional choices. Carol Dweck’s (2006) theory of mindset also supports this study. This theory asserts that there are two mindsets, fixed and growth. People with fixed mindsets believe they cannot change and often continue to behave the same way. People with growth mindsets believe they can change and evolve, thus teachers with a growth mindset may be more amenable to employing inquiry methods.

Teacher Beliefs about Inquiry

One of the constructs under investigation was teacher beliefs about inquiry, and their possible effects on instructional decisions. A study supporting the idea that teachers make instructional decisions based on their beliefs was conducted by Engel and Randall (2008). They asserted that teachers must understand the goals of their teaching to enable the outcomes they envision. In their qualitative study, 31 teachers were randomly assigned either to complete a science worksheet with a child, or to help the child learn more about the topic. The teachers who believed that their goal was to help students complete a worksheet were more likely to discourage students from expressing curiosity or deviating from the plan by questioning, even if those teachers were generally friendly and encouraging. The teachers who believed that their goal was to help students learn more about science were much more likely to allow questioning and to question students themselves. This suggests that it could be helpful for teachers to concretely identify their goals for student learning before planning instruction. If the goal is to help students learn more about a topic at a deeper level, that goal could lead teachers to plan inquiry lessons.

Although teacher beliefs might influence their choice of instructional methods, one study suggested that teachers did not implement methods that matched their beliefs as often as they supposed. In a causal-comparative and correlational study, Marshall, Horton, Igo and
Switzer (2007) found that even when teachers expressed a strong belief in the use of inquiry, the amount of time actually spent in its practice was significantly less than stated. The teachers reported that the ideal mean time that should be devoted to inquiry learning was 57%, but the actual mean time spent during an instructional day on inquiry teaching was 39%. In this case, the teachers’ beliefs did not translate into practice; however, awareness of this discrepancy between the real and ideal amount of time spent on inquiry learning could be perceived as a catalyst for teachers to increase their use of this effective pedagogical method.

The premise that teacher beliefs affected choice of instructional methods also held true when teachers strongly believed in the use of lecture and direct instruction. Despite acknowledging the benefits of inquiry education, some teachers were likely to cling to methods they considered effective, efficient, and easy to implement. One of the findings in a study by Deignan (2009) in the United Kingdom discovered resistance to inquiry implementation by faculty. Opinions about lecture and inquiry learning were solicited from 16 teachers and 9 students. All of their viewpoints were positive toward inquiry, revealing the belief that inquiry can improve teaching and learning quality. However, both students and teachers felt that inquiry was difficult, and that appropriate training was necessary to implement it correctly. Assessment was seen as more complex than with traditional methods. Also, there was some concern that the attitudes of teachers who used lecture would prevent them from trying inquiry, because they already believed that lecture was the best way to deliver instruction. This study illustrated the need for proper professional development and support when asking teachers to employ a new methodology.

Several studies questioned the value of inquiry. Some researchers considered inquiry as being too open and not providing enough support to learners. For example, Hume and
Coll (2010) conducted a qualitative multi-case study to examine learning in inquiry science classrooms in New Zealand. They observed lessons in one classroom at two different schools. The researchers found that students practiced some inquiry skills in research, but they did not pose original questions. They cautioned that the teacher’s interpretation of the curriculum and the way curriculum is delivered can result in a different experience than intended for students, such as when the teacher misunderstood the nature of inquiry learning and thwarted the students’ opportunity to conduct investigations of their own design. However, the small size of the study did not allow for generalization.

A stronger voice against inquiry and in favor of direct instruction comes from the work of Kirschner, Sweller, and Clark (2006), which has been cited in many articles (Alfieri, Brooks, Aldrich, & Tenenbaum, 2011; Cobern, Schuster, & Adams, 2010; Dean & Kuhn, 2006; Sahin, Isikal, & Ertepınar, 2010). Their meta-analysis comparing inquiry learning and direct instruction provoked responses from other researchers who provided some valid arguments against Kirschner, et al.’s (2006) conclusions. Kirschner, et al., (2006) analyzed 117 studies comparing research on direct instruction and inquiry, which they named discovery instruction. They used the results of their meta-analysis to advocate direct instruction for knowledge accumulation in the long-term memory. The authors contended that student learning was dependent upon the teacher’s knowledge and pedagogical expertise. They denigrated experiential learning and constructivist approaches, saying, “As so far as there is any evidence from controlled studies, it almost uniformly supports direct, strong instructional guidance” (p. 83). The researchers appeared to have chosen not to include studies favorable to inquiry. Although direct instruction is a necessary and useful method, Kirschner, et al., (2006) neglected to realize that without the inclusion of 21st Century Skills
taught through effective methods such as inquiry, Americans’ ability to think, synthesize information, reason, problem solve creatively, and communicate will deteriorate, along with the economy (Darling-Hammond, 2007). A quotation from Darling-Hammond’s (2006) work explains the dire need for a change in teacher practice:

Education is increasingly important to the success of both individuals and nations, and growing evidence demonstrates that…teachers’ abilities are especially crucial contributors to students’ learning. Furthermore, the demands on teachers are increasing. Teachers need not only be able to keep order and provide useful information to students but also to be increasingly effective in enabling a diverse group of students to learn ever more complex material (p. 300).

Finally, a strong rebuttal to Kirshner, et al., (2006) was published by Hmelo-Silver, Duncan, and Chinn (2006). They agreed that minimally guided instruction is flawed. However, they pointed out that problem-based learning and inquiry learning were not discovery learning. In actuality, these two methods were highly scaffolded for student understanding and success.

**Teacher Perceptions about Educational Change**

One factor that could affect teacher use of inquiry is how teachers perceive instructional change in education. Sparks (1988) examined teachers’ attitudes towards change and improvements in teaching in a correlational, multi-case study. She found that even after training in Stalling’s (1979) *Effective-Use-of-Time* to improve student time-on-task and interactive instruction, non-improving teachers tended to defend their present teaching, had low expectations for themselves and students, and rarely tried new teaching methods. Teachers who improved tended to have higher self-efficacy in their profession.
A qualitative case study by Obara and Sloan (2009) investigated how three sixth grade mathematics teachers coped with change when a new state-mandated curriculum was implemented. The subjects consisted of a sample of convenience and were willing to take part in the study. They taught a diverse population of students including many who qualified for English as a Second Language services. Data were collected from audio and visual recordings of interviews and observations. Teachers received training in the use of materials and the new curriculum. When teaching the new curriculum, the teachers reported believing that their practices had changed dramatically. However, the researchers did not detect much change. The results indicated that the teachers needed more time and resources to try new approaches to teaching. The researchers also found that the teachers needed more training in adapting instruction for culturally and linguistically diverse learners.

**Teacher Experience with Inquiry as Students**

Albert Bandura (1995) stated that personal beliefs regarding one’s efficacy can be developed through several influences. One influence pertinent to this study is mastery experiences. Bandura thought that successful experiences caused people to develop self-efficacy, and a strong belief in their abilities was related to their achievement. Based on his research, it is logical to assume that the more experience a teacher has with a topic, the more likely the topic will be internalized and utilized in the classroom (Bandura, 1995). In a qualitative study investigating pre-service elementary school teachers’ experiences learning science through inquiry, and science majors who learned the same content through more traditional lecture, Sanger (2008) found that both groups of students learned science similarly, although the students involved with inquiry did slightly better on tests. Sanger determined that the inquiry students experienced science as a way of explaining nature, while
the traditional students experienced it as a set of unrelated facts. Also, pre-service elementary school teachers involved in inquiry learning acquired ideas about how science should be taught based on their own experiences, demonstrating their profound views of how science is actually performed in the field (Sanger, 2008). The students who learned science through inquiry exhibited increased interest and confidence about teaching science in their own classrooms. The author maintained that this study made a strong case for teaching teachers science content through inquiry. Two of the teachers were quoted as saying that they used inquiry in their lessons because of their own experiences learning with inquiry.

Problem-based learning (PBL) is one variation of inquiry in which learning is centered on solving a problem that has no single answer (Hmelo-Silver, 2004). Kwan (2008) qualitatively studied 13 student teachers’ reactions to PBL in Hong Kong. All of the student teachers were enrolled as students in the Post Graduate Diploma in Education program at the University of Hong Kong. All of the pre-service teachers struggled with learning through problem-based learning, but despite the difficulty the student teachers experienced, they recognized its effectiveness in making students accountable for their learning.

**Teachers and Problem-solving Style**

Because problem-solving is intimately connected to inquiry (NRC, 1996, 2000), the relationship between inquiry and teachers’ problem-solving styles was identified as a construct for this study. The measurement of problem-solving style is relatively recent (Treffinger, Selby, Isaksen, & Crumel, 2007), and this new ability to explain problem-solving style may illuminate whether it is influential in teachers’ decisions to implement inquiry learning in their classrooms.
It is logical, as Cooney (1985) noted, to think that inquiry and certain problem-solving styles would be related. His qualitative case study investigated a beginning teacher’s first three months of teaching, his view of problem-solving, and his practice in the classroom. Cooney hypothesized that if teachers valued problem-solving, it would make sense for them to use inquiry in their teaching. The subject in Cooney’s study stated a belief that mathematics is primarily problem-solving. However, when examining the teacher’s actual practice, it was discovered that he began teaching content and problem-solving separately in a loosely organized way, and as time went on he perceived teaching as more difficult and adopted the teach-by-the-book approach. In this case, teacher beliefs did not translate into practice.

A process for evaluating problem-solving style was developed by Treffinger, et al. (2007), making it possible to identify the problem-solving style preferences of frequent and infrequent inquiry-use teachers. The authors of the problem-solving style instrument VIEW: An Assessment of Problem-solving Style (Selby, Treffinger, & Isaksen, 2007) developed the tool to appraise three main dimensions they believed were connected to problem-solving. These consisted of Orientation to Change, which represents how people react when faced with change; Manner of Processing, which reflects their use of energy, resources and the environment; and Ways of Deciding, which is concerned with decision-making to solve complex problems. Individuals may use the results of VIEW: An Assessment of Problem-solving Style (Selby, et al., 2007) to understand their responses to instructional change and improve their problem-solving abilities. This research study utilized VIEW: An Assessment of Problem-solving Style (Selby, et al., 2007) to determine if problem-solving style was influential in teacher decisions about instructional practice.
Methodology

The following questions guided this investigation.

Research Questions

1. What are teachers’ understandings and beliefs about teaching and inquiry?
2. What are teachers’ perceptions about instructional change?
3. What are teachers’ experiences in using inquiry as students?
4. What are catalysts and barriers to using inquiry methods in the classroom?
5. What are patterns of problem-solving traits among teachers?

Setting and the Subjects

Initially, seven urban and suburban school districts in New York and Connecticut were contacted to participate in the study. The subjects were purposefully selected from a group of 40 third, fourth and fifth grade teachers, most of whom had a minimum of five years’ experience in the classroom. All 40 teachers were administered a 5-minute researcher-designed instrument, Survey to Identify Teaching Styles (SITS; see Appendix B). The survey accurately identified teachers who used direct instruction; however after administration, the researcher determined it did not differentiate teachers who frequently implemented inquiry lessons. Either the instrument was not sensitive enough to identify frequent inquiry-use teachers, or the original pool of teachers did not contain teachers who used inquiry often. Therefore, the researcher sought out colleagues knowledgeable about inquiry education and asked for referrals to candidates who were known for practicing inquiry methods. Teachers who were frequent inquiry-users were purposefully chosen from among this reference group. The final pool of candidates consisted of nine subjects who composed a sample of maximum
variation, divided into teachers who identified themselves as less frequent users of inquiry on the survey, and those known for inquiry implementation (Merriam, 2009).

**Research Design**

This study employed the qualitative paradigm in the form of a heuristic multi-case study, because the researcher wanted to illuminate and explain the catalysts and barriers for teacher inquiry use (Merriam, 2009). A hermeneutic perspective was taken to interpret the subjects’ experiences holistically (Koro-Ljungberg, Yendol-Hoppy, Smith, & Hayes, 2009). This perspective allowed for interpretation of how each subject perceived or experienced inquiry as a unique individual. Triangulation was employed for credibility, by cross-referencing what the teachers said and what they actually did. Triangulation by source (more frequent and less frequent users of inquiry) and method (interviews, observations, and problem-solving styles assessment) established trustworthiness. Data from the observations and interviews were used to increase internal validity and credibility (Merriam, 2009). Multiple methods served as a means of gleaning insight from the participants to identify emerging trends and patterns. Member checking also verified that results were accurate to increase internal validity and avoid misinterpretation (Merriam, 2009). An audit trail for confirmability was established (Lincoln & Guba, 1985).

**Instruments**

**Survey to identify sample.** A researcher-designed tool, *Survey to Identify Teaching Styles (SITS)*, was distributed to 40 teachers from eight schools to identify their level of inquiry use. A 4-point Likert scale was employed to elicit responses regarding teachers’ instructional styles, specifically regarding direct instruction and inquiry practices. The survey consisted of 16 questions. Eight items were written to identify direct instruction
strategies (Rosenshine, 1978, 2008; Rosenshine & Meister, 1995) and eight to identify inquiry instruction strategies (Aulls & Shore, 2008). The survey was given to a panel of five experts from Western Connecticut State University and McGill University to verify content validity. A reading specialist and a principal were also asked for feedback in their capacity as instructional leaders. Only questions agreed upon by the panel of seven were retained. Several questions were rewritten using suggestions from the panel, and the survey was returned to two members of the panel for confirmation. When confirmation was received, the survey was adopted for use in this study.

**Field journal.** A reflexive field journal was kept to provide an audit trail, check for bias, and to reflect on the researcher’s various experiences during the study. Each entry recorded the setting, time, participants, and the researcher’s observations, feelings, thoughts, and hypotheses regarding teacher responses and the use of inquiry (Lincoln & Guba, 1985; Merriam, 1998). The use of this journal allowed reflection and incubation of the researcher’s ideas during the process. The journal notes were audited by an expert who held a doctoral degree and had completed his dissertation on inquiry. His audit served to assess whether the study was carried out appropriately, in a way that controlled for confirmability, dependability, and credibility.

**Observations.** One 60-minute observation was conducted to confirm more or less frequent use of inquiry in the classroom. The observations were scripted, and the *Electronic Quality of Inquiry Protocol* rubric (*EQUIP*, Marshall, Horton, Smart, & Llewellyn, 2008; see Appendix D) and other notes were filled out immediately following the observed lesson (Merriam, 2009).
The *Electronic Quality of Inquiry Protocol*, or *EQUIP* rubric (Marshall, Horton, Smart, & Llewellyn, 2008), was used during the observations to document the level of inquiry implementation. The researcher used a paper and pencil version for the observations, but the instrument is also available as an App for iPads. To gain proficiency, the researcher piloted the use of the rubric before beginning the study. The observations were scripted, and the rubric and other notes were filled out immediately following the observed lesson (Merriam, 2009). The *EQUIP* instrument (Marshall, et al., 2008) provided a chart for recording activity codes at 5-minute intervals during the observation. A panel of experts from Clemson University evaluated *EQUIP* (Marshall, et al., 2008) for face validity and came to consensus after several adjustments were made. Cronbach’s alpha was used, indicating strong internal consistency ($r = .82-.89$). Inter-rater reliability was moderate to substantial, with Cohen’s kappa averaging .61 for the instruction indicators. A confirmatory factor analysis confirmed content and construct validity (Marshall, et al., 2009; see Appendix E for alignment between *EQUIP* and the definition of inquiry).

**Interviews.** A list of interview questions was developed by the researcher and field tested in anticipation of the study (Merriam, 2009; see Appendix C for interview questions). Practice interviews honed the researcher’s interview skills and indicated which questions obtained the best information prior to implementation of the research. The interview questions encouraged teachers to discuss their experiences with inquiry use, their experiences learning through inquiry methods, their perceptions about instructional change, teachers’ problem-solving styles as they related to instructional decision making, teachers’ beliefs about teaching, and perceptions of their own teaching styles. Question reframing was used (Merriam, 2009). All interviews were tape recorded and augmented with field notes.
Interviews were transcribed verbatim, assigned pseudonyms to protect teacher identities, and transferred into HyperRESEARCH (Research Ware, 2009) to aid in identification of emergent trends and themes.

**VIEW: An Assessment of Problem-solving Style.** To examine the possibility that a teacher’s problem-solving style might influence instructional decision making, a problem-solving styles instrument called *VIEW: An Assessment of Problem-solving Style* (Treffinger, Selby, Isaksen, & Crumel, 2007; see Appendix F for problem-solving styles model of *VIEW*) was used to ascertain if there were certain common traits among frequent and infrequent inquiry-use teachers. The traits were examined to determine the presence of a relationship between the traits and frequency of teacher inquiry use.

*VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007) includes an assessment of problem-solving style through a model based on three dimensions: Orientation to Change (Explorer-Developer), Manner of Processing (External-Internal), and Ways of Deciding (Person-Task). It consists of 34 items using a 7-point Likert scale, and is appropriate for ages 12 to adult. All items were presented as positive choices, so one preference would not be perceived as better than another.

Reliability was established through stability using test-retest correlational data. Three studies confirmed stability. All correlations were moderate to high as reported by the authors. Further reliability was established by internal consistency analyses. The current version of *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007) has alpha coefficients of .91 (Orientation to Change), .87 (Manner of Processing), and .87 (Ways of Deciding). The authors stated that factor analyses confirmed the hypothesized factor structure, and that “all items of *VIEW: An Assessment of Problem-solving Style* are aligned
with their theoretical dimensions” (Selby, Treffinger, Isaksen, & Lauer, 2002, p. 236). Also, initial criterion-related validity indicates that problem-solving style is distinctly different from creative abilities.

**Description and Justification of the Analyses**

When working with people, there is never a one-dimensional truth about a particular topic, such as teachers’ perceptions regarding the catalysts and barriers to their decisions about inquiry use. A qualitative paradigm was chosen to allow the researcher to examine and interpret the multi-faceted perceptions of the subjects (Lincoln & Guba, 1985). In this study, humans served as instruments (Lincoln & Guba, 1985) who reported on their understandings, experiences, and preferences regarding implementation of inquiry learning. At this point in time, no quantitative method could accurately measure the information elicited from these teachers. The qualitative approach was the best way to understand and interpret teachers’ insights regarding the research questions explored in this study.

Profiles of inquiry users were contrasted and regrouped as patterns emerged. Data were coded using HyperRESEARCH (Research Ware, Inc., 2009) and described in a dense narrative to discover, verify, and comprehend the phenomena of potential catalysts and barriers for implementation of inquiry instruction in experienced elementary teachers’ classrooms. A code-recode system was used throughout to increase the dependability of the study. The interviews were audio recorded and then transcribed verbatim, and a content analysis designed to search for themes, patterns and trends was performed. The data were coded and grouped according to theme. The themes were mutually exclusive, clearly delineated, and heuristic, allowing the researcher to discuss, explain and evaluate the data. Credibility was achieved by triangulation and by maintaining a sense of the individuality of
each subject’s perception of reality and accurately describing it (Merriam, 2009). A reflexive field journal was kept to minimize researcher subjectivity and to provide evidence of the interactions during the study. Confirmability was established through the use of the field journal, audio recordings, member checking, and triangulation of the information collected (Krefting, 1991; Lincoln & Guba, 1985). Classroom observations were conducted, using the EQUIP rubric (Marshall, et al., 2008) to confirm the level of inquiry.

**Limitations of the Study**

The sample for this study was purposefully chosen from among volunteers who were either frequent or infrequent users of inquiry. The threat of mortality, in which subjects leave the study for any reason, was minimized by collecting all of the necessary information at one meeting with each participant. Truthfulness on the part of the subject is an issue throughout every qualitative study. For this reason the interviews were semi-structured. Teachers were made comfortable and allowed to follow their own trains of thought when possible. The researcher reassured the participants that a strict policy of confidentiality would be maintained.

Triangulation of the data by use of interviews, observations, and the results of VIEW: An Assessment of Problem-solving Style (Treffinger, et al., 2007), plus member checking, helped to ensure trustworthiness. The field journal helped to control for bias and provided space and time for reflection and incubation of ideas (Krefting, 1991).

The next chapter contains a review of the body of literature pertinent to the research questions. Current research concerning the constructs of this study, related to the theoretical foundations, teacher beliefs about inquiry, teachers and educational change, teacher experience with inquiry as students, and problem-solving styles, was explored.
CHAPTER TWO:

REVIEW OF THE LITERATURE

In this increasingly global economy, it is imperative that US students receive a superior education, gaining the knowledge and skills to contend with world competition when they enter the workforce (Darling-Hammond, 2007). Because proper implementation of inquiry methods teaches and nurtures inquiry skills, students should be exposed to these methods as early as possible to help them to develop the way of thinking to approach problem-solving in an effective manner. Students will need to be flexible and creative in their thinking if they are to succeed in a world of uncertainty, and the ability to utilize inquiry skills will provide a structure within which novel problems can be framed (Dweck, 2006; National Research Council, 2000).

A profuse amount of research has been conducted on the topic of inquiry, especially within the last 10 years. To assay this vast body of knowledge, it was necessary to narrow the topic to the constructs directly related to the research questions. First, the underlying theories supporting this study are presented, including constructivism, the theory of planned behavior, and the theory of mindset (Ajzen & Fishbein, 1980; Dewey, 1910; Dweck, 2006).

A general overview of the need for students to comprehend and employ inquiry skills for 21st Century jobs ensues, followed by a review of the literature as it pertains to the constructs selected for investigation in this study. This chapter examines salient research pertaining to the influence of the following constructs on teachers’ decisions to employ inquiry learning in their classrooms: teaching style, teacher beliefs about inquiry learning, teachers’ reactions to instructional change, teachers’ experience learning through inquiry when they were students, and problem-solving style traits.
Theoretical Constructs Underpinning this Research Study

Constructivism and Inquiry

Constructivism was the foundational theory that supported this investigation (Bruner, 1977; Dewey, 1910; Vygotsky, 1978). It was augmented by two other theories: the theory of planned behavior, and the theory of mindset (Ajzen & Fishbein, 1980; Dweck, 2006). Together, these theories supported this investigation into teacher-held beliefs about education and inquiry. Inquiry learning is based on the theory of constructivism, which asserts that students learn by constructing meaning from their experiences with the world around them (Bruner, 1977; Dewey, 1910; Vygotsky, 1978). The theory maintains that reality is decided by the learner from the perspective of meaningful activity, and depends on the perceptions of the individual (Aulls & Shore, 2008). Through experience, students gain insight and learn the nature of the discipline being studied rather than just memorizing and regurgitating facts.

John Dewey (1910) observed that the scientific advances that were turning America from an agricultural to an industrial society necessitated the development of a new way of envisioning schools. Students would have to be prepared to cope with the new, emerging industrial jobs. He believed that as future members of the social order, children should be taught in a social setting instead of the individual, competitive structure, which was predominant in agrarian societies. In fact, Dewey’s scenario is no doubt familiar to educators today, who are seeking effective ways to prepare students for new and unknown jobs in the 21st Century (Brown, 2006; Darling-Hammond, 2007) as society is once again radically changing, this time from an industrial to an information age.

Constructivism supporter, Jerome Bruner, speaking about the need for social learning between students and teachers, went so far as to say:
So much of learning depends upon the need to achieve joint attention, to conduct enterprises jointly, to honor the social relationship that exists between learner and tutor, to generate possible worlds in which propositions may be true or appropriate or even felicitous: [T]o overlook this functional setting of learning—whatever its content—is to dry it to a mummy (Bruner, 1977, pp. xiv-xv).

**Planned Behavior and Instructional Decision-making**

The theory of planned behavior is also pertinent to this study (Ajzen & Fishbein, 1980). This theory has been used in many different fields, including health, business, social work, and education, to predict how people will behave under particular circumstances (Campbell, 2010; Heesup, Sungil, & Coong-Ki, 2011; Hwu & Chin-Ching, 2006; Knowlden, Sharma, & Bernard, 2012). In an educational context, this theory asserts that teachers’ attitudes, beliefs and experiences are fundamental to how they decide to teach. Strong attitudes often predict behavior better than weak attitudes (Christian, Armitage, & Abrams, 2003). Consequently, if teachers strongly believe that students have a significant role in learning, inquiry would be a more likely pedagogical choice. If they hold strong beliefs that the teacher is the main conduit of learning, they would be more likely to utilize direct instruction (Ajzen, 1988, 1991, 2001; Ajzen & Fishbein, 2008). Therefore, understanding teacher attitudes and beliefs about inquiry implementation is necessary for understanding their decisions to utilize inquiry.

**Mindset: Beliefs Inform Actions**

A theory related to how individuals choose behaviors, advanced by Carol Dweck (2006), concerned the malleability of the mind. Mindset theory is connected to this research study because it extends the theory of planned behavior (Ajzen & Fishbein, 1980) to include
the possibility that people can grow and change their beliefs about what they are able to do. If mindsets can be altered, professional development in inquiry education might help teachers to be more receptive to its usage. Consequently this theory is included as an adjunct to Ajzen and Fishbein’s theory of planned behavior (1980).

According to Dweck (2006), mindset is based on the power of people’s beliefs that they can influence their actions. Dweck identified two mindsets: the fixed mindset and the growth mindset. She contended that people who possessed a fixed mindset had great difficulty changing their attitudes and beliefs because they thought their traits were fixed, while people with growth mindsets were able to improve and change because they believed they could develop and increase their talents. In her book, Dweck described a study that she and her colleagues Lisa Blackwell and Kali Trzesniewski (2006) conducted with seventh graders just entering junior high school. The researchers determined the students’ mindsets and divided them into fixed and growth mindset groups. Over the next two years, the growth mindset group excelled in school, while the fixed mindset group struggled. The researchers taught half of the fixed mindset group study skills, and the other half about how the brain makes new connections when the students learned something new. The students receiving training about the brain were able to change their thinking, developed growth mindsets, and began to achieve higher grades in school. Those who learned study skills did not change their mindsets.

Dweck’s (2006) theory complements the theory of planned behavior by adding the premise that minds are malleable, thus subject to change under certain circumstances. Practical, on-going professional development opportunities relative to inquiry-based learning
would logically be supported by this theory. It may be that teachers’ decisions about inquiry implementation could be influenced and changed with training.

**Importance of Inquiry**

21st Century learning skills have been identified as necessary abilities for today’s students to prepare them for the fast-changing job market of the future (Brown, 2006; Darling-Hammond, 2007; Johnson, 2009). Therefore, it is crucial that educators enact rigorous instruction to help US students compete and succeed in what has become a global economy (Brown, 2006; Darling-Hammond, 2007; Fleischman, Hopstock, Pelczar, & Shelley, 2010). One efficacious way to accomplish this goal is to implement inquiry learning.

**Definitions of Inquiry**

Several definitions of inquiry exist because it is interpreted differently among educators (Anderson, 2002; Lee & Ash, 2010; Moseley & Ramsey, 2008). After some investigation, two definitions were found to apply to this study. The definition of inquiry that grounds this present study is:

Inquiry is learning by questioning and investigation; the questions asked and means for investigation are vast, nonlinear, and idiosyncratic. Inquiry encompasses diverse ways to study phenomena in all subject areas through dialogue, asking questions, and proposing explanations based on empirical evidence (NRC, 1996). A requirement of inquiry is that the goal of learning is “to do” and “to learn about” at the same time. Inquiry requires imaginative, evidence-based explanations achieved through critical thinking and a deep understanding of concepts (Shore, Birlean, Walker, Ritchie, LaBanca, & Aulls, 2009, p. 1).
Goals of Inquiry

Implementation of inquiry learning has been demonstrated to be an effective pedagogy because it accomplishes several goals. Some of its benefits to students include enhanced critical thinking skills, the ability to pose questions, the opportunity to design investigations to answer questions, and the ability to work with others in a collaborative manner. No matter which instructional methods they choose, teachers need to know the content well to support and guide student learning. Inquiry education provides support for teachers as content is delivered, because they must keep abreast of the material their students are investigating. Inquiry investigations compel teachers to continue learning about the topics students choose because teacher knowledge can be applied to support and guide students (Luera & Otto, 2005). Expert teachers of inquiry can present high quality lessons that engage and motivate students, making learning interesting and durable (Darling-Hammond, 2007; Drake & Long, 2009). Many other studies about inquiry-based education found student learning to be superior to traditional lecture or direct instruction when implemented correctly (Anderson, 2002; Dean, 2006; Dean & Kuhn, 2006; Kangas, Seitamaa-Hakkarainen, & Hakkarainen, 2007; Thomas & Oldfather, 1996). For example, Anderson (2002) conducted a meta-analysis of 27 studies on the effectiveness of inquiry as a pedagogical method. He concluded that inquiry teaching produced positive results on cognitive achievement, process skills, and students’ attitudes toward science. However, these positive effects could only be achieved if the teacher knew how to implement inquiry correctly. He drew a distinction between inquiry learning and discovery learning, saying that discovery learning did not provide the guidance and support of inquiry and did not produce the same positive effects.
In his dissertation study on the development of scientific thinking skills in 44 fourth grade students, David Dean compared the efficacy of inquiry and direct instruction (2006). Dean conducted a posttest-only comparison of three randomly assigned groups: direct instruction only (DI), an introductory session with no instruction plus inquiry practice only (PR only), and direct instruction with inquiry practice sessions (DI+PR). The students were asked to work on computer programs designed to teach controlled comparison (CC) skills, which are related to the ability to control variables to conduct scientific investigations. After 12 sessions over 9 weeks, an assessment was administered and a significant difference ($p = .03$) was found between the two groups using inquiry practice and the DI only group. Dean concluded that over time, direct instruction was not necessary for learning CC skills. Dean stated that the DI+PR group eventually made the same gains as the PR only group, indicating that DI was not a necessary component of learning. In this study, inquiry practice was deemed superior to direct instruction.

**Lessons in Inquiry**

A large body of research exists that demonstrates the effectiveness of inquiry and direct instruction for student learning. However, there were some studies that denounced inquiry in favor of direct instruction. The researchers who opposed inquiry learning often equated it with unguided discovery learning, in which the learner is expected to construct meaning with little to no help. For example, Richard Mayer (2004) conducted a meta-analysis of research from the 1950s through the 1990s. This historical review included 35 articles describing studies concerning the use of discovery learning. The authors discussed the benefits and problems of discovery learning, with and without teacher guidance. Based on the information in these articles, Mayer asserted that constructivist methods, also labeled
discovery learning, failed by requiring the student to discover problem-solving rules in addition to solving problems with little or no guidance. Mayer claimed that the inefficiency of discovery education interfered with student learning rather than enhancing it. He also disparaged discovery learning because it was not useful when teaching conservation strategies or computer programming concepts. He concluded that constructivist methods were “fuzzy and unproductive…educational ideologies (p. 18).”

Alfieri, et al. (2011) agreed with Mayer (2004) that discovery learning lacked structure and definition. They emphasized the necessity for guidance and practice when learning new skills. In their meta-analysis, they compared unassisted discovery learners with guided discovery learners. They concluded that unassisted discovery methods did not enhance student learning, but guided discovery learning was beneficial. Alfieri, et al., (2011) did not entirely dismiss constructivist views as Mayer (2004) had. They surmised that adding guidance and scaffolding to discovery learning resulted in the ideal combination of methods for student learning.

One study attracted the attention of several pro-constructivist researchers. Kirschner, Sweller and Clark (2006) conducted a meta-analysis, claiming that inquiry did not work because it required too much effort by short-term memory, thus blocking learning in long-term memory. They used many old studies from the 1940s through the 1970s to make the point that direct instruction alone resulted in lasting learning. One argument they advanced was that the human ability to perform any task was dependent on the person’s experience, which was then stored in long-term memory. They did not acknowledge that inquiry practice gave the human mind experience to use in later learning. They also neglected to include any studies that supported the use of inquiry, rendering their inferences unbalanced. Kirschner, et
al., (2006) demonstrated their lack of understanding about the nature of inquiry by claiming that students received limited guidance and information with which to solve problems. Quality inquiry required a knowledgeable mentor, often in the form of a teacher, who provided guidance and help where needed. Furthermore, they asserted that constructivism, upon which inquiry is founded, compelled students to learn an entire body of knowledge through experience with minimal feedback. The following responses to Kirschner, et al. (2006) ensued.

**Need for balance.** Kuhn (2007) responded to the Kirschner, et al., article (2006) by explaining that in her own research, direct instruction did not always result in retention of learning or transfer to unfamiliar content. She chastised them for claiming that direct instruction was superior to all other forms of learning regardless of the content. She asserted that the subject matter should dictate the teaching method, and that inquiry engaged students in the content so that higher order thinking could occur. Kuhn reminded Kirschner, et al. (2006), that in the future, it will be essential for students to know how to problem-solve and how to argue respectfully, which were both attributes of inquiry learning. Finally, she concluded that there is a place for both inquiry-based methods and direct instruction depending on the content being taught.

Another rebuttal came from Hmelo-Silver, et al. (2007). This paper described inquiry learning and problem-based learning as structured and scaffolded, not as minimally guided discovery learning. The researchers cited several studies that problem-based learning and inquiry learning were significantly more effective than traditional learning. One such study by Hickey, Wolfe, and Kindfeld (2000) used a technology program for investigating genetics with high school students. Although the investigations were open-ended, the students were
able to use simulations and representations of problems to scaffold their learning. The students learning through this inquiry-based technology achieved significantly higher gains from pretest to posttest than students in the traditional classes.

Students learn by doing through collaboration, posing questions, searching for meaningful answers to their questions, organizing and communicating data, and practicing social skills and creativity (Brown, 2006; Dewey, 1910; Drake & Long, 2009). Social skills and creativity will be vital to the future of all students as they struggle to adapt to the changing economic scene. Inquiry can assist students in acquiring these skills. The question is, if inquiry-based learning can be such an effective tool, why do some teachers avoid its use while others embrace it?

**Teacher Beliefs and Inquiry**

Based on the theories of planned behavior and mindset (Ajzen & Fishbein, 1980; Dweck, 2006), teacher beliefs about inquiry were identified as relevant constructs for investigation in relation to teachers’ instructional decisions. It is reasonable to assume that teachers develop their constructs, theories, and beliefs about how students learn from their own experiences in the field, and that they choose their teaching approaches to support those beliefs. Many recent studies have investigated this idea (Futark & Alonzo 2010; Meyer & Avery, 2010; Pozuelos, Gonzalez, & Leon, 2010; Roehrig & Kruse, 2005). Roehrig and Kruse (2005) explored the effect of teacher beliefs and knowledge on the implementation of a new reform-based curriculum. This mixed-method study included 12 high school chemistry teachers. The teachers taught tenth-grade chemistry primarily through direct instruction, utilizing textbooks. The school system had decided to transition to an inquiry-based science curriculum to match the concepts outlined in the National Science Education
Standards. Teacher practices were evaluated before and during field tests of the new inquiry-based program, Living by Chemistry (LBC, National Science Foundation, 2003). Two units of the program were field tested to determine if teachers could be helped to develop self-efficacy and confidence during inquiry teaching. Professional development was offered prior to use of LBC.

Teacher beliefs about teaching were collected through the Teacher Beliefs Interview (TBI), a semi-standardized tool that utilized selected questions from the Teachers’ Pedagogical Philosophy Interview (Richardson & Simmons, 1994). These tools included prompts about the teachers’ definitions of inquiry in the classroom, and experiences teaching LBC. The responses were coded using the manual’s coding maps, and categorized as traditional, instructive, transitional, responsive, or reform-based.

The Reformed Teaching Observation Protocol (Sawada, Piburn, Judson, Turley, Falconer, Benford, & Bloom, 2002), or RTOP, was used to score observations of the teachers. Five of the 12 teachers demonstrated minor changes in teaching style with LBC because of their more traditional views of teaching and learning. Seven of the teachers exhibited large changes in practice with LBC because they felt supported by the curriculum, and they were more open to change. The researchers concluded that teacher beliefs played a large role in how the LBC program was implemented. They also inferred that teacher content knowledge influenced teacher self-efficacy in implementing the curriculum. No permanent changes in teacher beliefs were found; this may have been due to the small number of teachers and the short time period of the study. Even though fundamental changes in beliefs were not found, the study demonstrated that beliefs held at the time influenced how teachers were willing to change their practice. It also illustrated that teachers were more
comfortable implementing a new program when they possessed adequate content knowledge and received professional development.

In a year-long Australian study, Makar (2007) strove to understand teachers’ experiences teaching mathematics and statistics through inquiry instruction. Makar was especially interested in how teachers developed and sustained inquiry instruction over time. She wanted to learn about teachers’ perceptions of supports necessary for them to maintain the use of inquiry. Makar noted that inquiry in mathematics calls for students to pose and solve ill-structured problems, and that life is filled with such problems. Therefore, teaching students how to deal with them was important to their mathematical understandings. Makar believed that this task could be accomplished through inquiry learning.

The subjects were four teachers of eight- to ten-year-olds who volunteered to participate in the study. An intervention was conducted using full-day professional development planning sessions every 10 to 12 weeks. During the planning sessions, the teachers worked to solve ill-structured problems, had discussions, and planned lessons. Pairs of teachers worked together to design and implement several inquiry units to ensure that they experienced the iterative process. They were supported by the researcher who acted as staff developer. The researcher conducted observations to verify that the teachers followed through with the lessons they had planned. Factors that helped teachers grow in their use of inquiry-based learning included support and feedback from the researcher as staff developer, the iterative process, available materials and resources, collegiality among the teachers, content and knowledge development, time and support for reflection, collaboration, and having beliefs consistent with inquiry use.
Makar identified important factors that facilitated the use of an unfamiliar instructional approach. In particular, the iterative process caused the teachers to improve because learning to implement inquiry required repeated practice. The teachers had the opportunity to evolve in their ability to master inquiry instruction. Time to reflect and have collegial discussions allowed teachers to refine and improve their skills while they were supported by an expert coach. Although the study was small in scale, the investigation identified some salient factors that could help improve teacher willingness to implement inquiry. These included more time for collaboration and reflection, repeated efforts, and expert or collegial support.

Another study examining teacher beliefs and teaching choices was conducted by Engel and Randall (2009). They wanted to comprehend how teachers’ beliefs about the purpose of their teaching influenced how they taught. Their sample consisted of 24 women and 7 men, with an average of 17 years of teaching experience. The subjects were randomly assigned to one of two groups. The first group of teachers was told to help some students complete a science worksheet on an experiment about floating and sinking. The second group was told to help students learn more about how things float and sink. They had 11 minutes to accomplish the task with students.

The students were three boys and three girls between the ages of 10 and 12. The children were coached prior to the experiment to deviate from the task by asking questions about the activity with each group of teachers. The sessions were video-taped, and teacher-student interactions were coded as encouraging, neutral, or restrictive.

In the experimental condition, 88% of the teachers encouraged student deviation from the worksheet and asked questions themselves. In the worksheet completion condition, only
13% of teachers encouraged any deviation from the task. This study illustrated that people will try to accomplish the tasks they have been given. Even though some of the teachers in the worksheet completion condition thought the students’ questions were interesting, they redirected students to get the job done. Ultimately, the teachers used their beliefs to guide their interactions with students.

Often, teacher beliefs were based on their experiences and knowledge. When teachers lacked content knowledge and did not understand how to implement inquiry practices, teachers reverted to more traditional methods. In 2009, Duran, Ballone-Duran, Haney, and Beltyukova published a study detailing Project ASTER III (Active Science Teaching Encourages Reform). Project ASTER III was developed to align curriculum and teaching with state, national, and science museum standards. The researchers asserted that lack of teacher self-efficacy with science and the inquiry method prevented them from using inquiry in the classroom. The project was established with the intent to give teachers hands-on experience with an inquiry-based curriculum at a museum so they would increase their feelings of self-efficacy about science and inquiry teaching.

Twenty-six kindergarten through third grade teachers attended five professional development seminars in a summer institute to participate in hands-on exhibits exploring inquiry-based science teaching. The teachers came from public and private schools in Ohio and had participated in either or both ASTER I and II projects. Two surveys were administered to measure teachers’ beliefs about inquiry-based teaching, and about science in general. The Survey of Teacher Beliefs in Inquiry-based Teaching (STBIBT) consisted of 28 questions with a 4-point Likert scale ranging from strongly disagree to strongly agree. It was considered a stable instrument with a Rasch reliability of .76. The second survey, Science
Teaching Efficacy Belief Instrument (STEBI; Riggs & Enochs, 1990), was comprised of 25 questions with a 5-point Likert scale. Both instruments were administered after the summer training institute, and again at the end of the project.

The results of the STBIBT signified that before and after the teachers’ inquiry experiences at the museum, most teachers agreed that inquiry-teaching involved students performing hands-on activities, helped students enjoy science and retain knowledge, engaged the students, and required more materials and teacher preparation time than direct teaching. The results from a chi-square that was conducted to compare teacher beliefs from the STBIBT before and after training, as well as after the field trip, indicated that the percentage of teachers who agreed that the teacher must discern student background knowledge prior to inquiry instruction significantly increased (p < .01). A significant increase also occurred in the percentage of teachers who believed that inquiry promoted individual learning (p < .01), allowed all students to explore topics in-depth (p < .01), and suited all learning styles (p < .01).

After the ASTER experience, the results of STEBI showed that the teachers believed that they taught science effectively (p < .001), and that they had the skills necessary to teach science well (p < .001). These results were not surprising when one considers that this was the second or third experience with Project ASTER for all of the participants. The repetition of inquiry-based experiences was meant to help teachers internalize their comprehension of inquiry education. This additional experience may have translated into more favorable attitudes toward inquiry.

Three themes emerged through coding in the qualitative portion of the Duran, et al. (2009) study. These were the impact on teacher understanding of inquiry, the increased
confidence in teaching science, and the benefits of collaboration. The professional development program produced significant positive effects on teachers in all areas. This study confirmed that teacher attitudes toward inquiry-based education can change with enough support, professional development, and experience. The iterative nature of the training contributed to increased teacher interest and competency in using inquiry methods. For the future success of our students, it is critical that teachers become enlightened about a range of teaching models, such as inquiry, in order to understand how it works so that they can use it to help students grow into capable 21st Century citizens.

Inquiry learning was a topic of interest to many countries world-wide. For example, inquiry learning is central to education in Turkey. Researchers there were interested in discovering the teachers’ beliefs about inquiry learning and its implementation. Twigg (2010) conducted a single school case study involving 11 teachers and 1 administrator. Twigg discovered some common beliefs of teachers who utilized inquiry-based learning. Every teacher in this study taught through the inquiry approach. Personal teacher beliefs included the belief that students should share in the ownership of information, and be lifelong learners. Another common belief was that teachers and students needed to be open-minded, confident, and have a fun, positive attitude toward inquiry.

Because the teachers felt that they had not been well-prepared for inquiry implementation in college, they expressed a belief in the need for professional development. The teachers also articulated the need for a culture of inquiry in the school. Twigg (2010) discovered that the teachers believed that all subject areas should be integrated instead of fragmented. The teachers also felt that they needed more time for guided discussions, reflection, sharing of ideas, flexible planning time, and collaboration.
Another Turkish study, conducted by Sahin, Isiksal, and Ertepinar (2010), sought to reveal possible differences in inquiry beliefs between gender, and by the type of school where teachers taught. This study utilized the Turkish version of Teacher Beliefs toward Instructional Pedagogies Questionnaire (Race, 2001). The sample consisted of 197 randomly selected teachers from public and private schools. Fifty-four of the teachers taught only elementary science, while the remainder taught kindergarten through fifth grade as general classroom teachers. There were 133 public school teachers and 64 private school teachers. More than half of the teachers had 10 or fewer years of experience, and the majority was female.

The questionnaire consisted of 31 items divided into four sections: beliefs in using inquiry (10 items), traditionally-based (7 items), technology-enhanced instructional strategies (8 items), and self-efficacy in teaching science (6 items). The questionnaire utilized a five-point Likert scale. The results of the questionnaire indicated that all of the teachers held a strong belief in the use of inquiry teaching. Ninety-one percent believed that students needed opportunities to construct meaning in science. Eighty-four percent believed that science instruction should include how to apply problem-solving in real-life situations, and 62% believed that students’ science ability would improve with use of the inquiry method. Less than half of the teachers believed that students learned best through textbooks or teacher explanations. Only 26% agreed that the teacher should be the primary tool for instruction. However, the majority of the teachers believed that it was important to practice, drill, and recall facts. Almost 90% of the teachers felt self-efficacious about teaching science. The majority of teachers believed that computers and technology were good tools for problem-solving in science and math. It was found that teachers from private schools felt more self-
efficacious about teaching science than public school teachers (p < .001). The researchers attributed this effect to the fact that private schools in Turkey offered more materials and opportunities for inquiry education.

Despite the importance of teachers’ need to understand their own beliefs and goals, Marshall, Horton, Igo and Switzer (2007) found in a causal-comparative and correlational study that even when teachers expressed a strong belief in the use of inquiry, the amount of time actually spent practicing inquiry was significantly less than stated. A survey was given to an entire school district of 1,222 K-12 science and mathematics teachers to measure their beliefs about and use of inquiry in the classroom. Four variables were found to be moderately related to the percentage of time that students actually engaged in inquiry and the percentage of time that teachers believed should be spent in inquiry learning. The four variables were grade level taught (p < .001), content area taught (p < .05), level of support received (r = .26), and self-efficacy for teaching inquiry (r = .32). Teachers reported that the ideal mean time that should be devoted was 57.3%, but the actual mean time spent during an instructional day on inquiry teaching was 38.7%. In this case, the teachers’ beliefs did not translate into practice.

Overwhelmingly, the literature supported the importance of teacher beliefs as an influence on instructional decision making (Duran, et al., 2009; Engel & Randall, 2009; Makar, 2007; Sahin, Isiksal, & Ertepinar, 2010; Twigg, 2010). Teachers followed their convictions when choosing which instructional methods they would use. If the teachers had enough content knowledge, understanding of inquiry education, support, and professional development, the majority of educators agreed that there were benefits to using an inquiry approach.
Teachers and Educational Change

Examining how teachers react to changes in their profession may provide insight into how to help them embrace the use of methodologies such as inquiry learning. A quotation from Basit (2003) seemed to sum up teachers’ feelings on this change: “Educational change can help teachers improve existing practice, but on the other hand it can also aggravate their problems. If the innovation is successful, teachers seldom get any credit; if it fails, they can get most of the blame” (p. 66).

It is logical to assume that the methods of implementing educational change may affect teachers’ ability and willingness to try new methods, such as inquiry, to improve their pedagogical practice. The literature described several potential influences on teachers’ reactions to changes in education. These included stage of life (Hargreaves, 2004), stage of career development (Maskit, 2011), and teacher emotions (Lee & Yin, 2011).

Stage of Life

Hargreaves (2004, 2005) believed that the stage of life during which a teacher entered the profession affected that person’s attitudes toward and goals for education. Stage of life referred to the political and economic happenings at the time of the teacher’s induction into education. The results from a study by Hargreaves (2004) were discussed in his article about generational differences between teachers. Hargreaves pointed out that events in the world are tied to the stage of one’s life, as evidenced by the Baby-boomer generation of teachers who came into the profession in the 1970s and 1980s. He explained that because of the great social upheaval during their youth, many of these teachers came to education with an agenda for social justice. They were interested in using education to help people improve the quality of life and move up in the world. Hargreaves contrasted the Baby-boomer generation with
Generation X teachers, who were younger and more enthusiastic, but lacked the former generation’s drive to improve children’s lives through education. The Baby-boomers took responsibility for the whole child and were protective of what and how they taught. Now they experience nostalgia for the past and feel demoralized by the imposition of mandated change that does not recognize individual and developmental differences (Hargreaves & Moore, 2005).

Stone-Johnson (2011) added to Hargreaves’ work by describing the generations as coming from predictable “waves of reform” (p. 223). When looking back over a 30-year period from the 1970s through the 1990s, she was able to identify three waves of reform. The first was the Age of Optimism and Innovation, from the mid to late 1970s. At that time, Baby-boomer teachers were idealistic, autonomous, and leading educational change themselves. Education became more child-centered.

The second wave was the Age of Complexity and Contradiction, a time of reaction instead of proactive efforts, from the late 1970s through the mid-1990s. This time period saw a decline of social democracy and confusing reforms as Generation X teachers entered the profession. The third wave, the Age of Standardization and Marketization, took place from the mid-1990s to the present. Millennial generation teachers have entered the field of education in this period. This age features globalization, lack of trust between teachers and the public, reforms based on measurable outcomes, a high level of accountability for teachers, and more teaching to the high-stakes test.

The newest generation of teachers grew up in a time of rapid change and technology, and may be more open to mandated change because they have been used to it since the time they were students themselves. This difference could cause friction and misunderstanding
between the generations, especially in their basic beliefs about what it means to educate a child. However, change is a hallmark of the 21st Century, and it will be imperative that teachers find a way to use new reforms as an opportunity to improve their practice. Perhaps the younger generation of teachers will be better prepared than the older generation to shepherd their students through changes in curriculum and methods to prepare them for an uncertain future. The 21st Century Skills, which include components of inquiry, will be vital to the success of students in times to come. The new generation of teachers may be more open to trying inquiry than more experienced teachers who may be set in their ways.

**Stages of Career Development**

There is evidence that the burden of implementing educational change has been shifted primarily to the teacher (Basit, 2003). This has created more pressure than ever before to accomplish policy changes that will increase student learning (Bjork, Kowalski, & Young, 2005). An investigation conducted in Israel by Maskit (2011) explored whether the teacher’s stage of development influenced attitudes toward educational change. The study employed the Teacher Career Cycle Model (TCCM; Burke, Christensen, Fessler, McDonnell, & Price, 1987), an eight-stage model to evaluate the career stages of practicing teachers. Preservice and career-exit teachers were excluded from the study. The sample consisted of 520 Israeli teachers, 360 who taught primary school, and 160 who taught junior high and high school. Four hundred fifty-five teachers taught in Jewish schools, and sixty-five taught in Arabic schools.

Maskit used three instruments and a sampling of interviews to collect data. A 4-point Likert scale questionnaire regarding teacher attitude toward educational change (cognitive, affective, and motivational attitudes) was administered first. A second questionnaire, using a
semantic differential format, was employed to assess teacher attitudes toward change. This instrument used a series of stimulus words at opposite poles. An open-ended statement was made and followed by nine pairs of opposing adjectives (e.g., beneficial-harmful). Respondents indicated their choices along a seven-point Likert scale.

Next, the teachers were asked to self-identify the stage of teaching and professional development that described them from the Teacher Career Cycle Model (TCCM; Burke, et al., 1987). Ten percent of the teachers considered themselves in the Induction phase, which are the first few years of teaching. In this stage, the new teachers were concerned with fitting in and becoming comfortable with their daily tasks. Forty-two percent of the teachers thought they were in the Competency Building stage, in which they were seeking new materials and strategies to improve their teaching skills and abilities. Twenty-two percent chose the Enthusiasm and Growth stage, demonstrating high job satisfaction, a high level of competence, and the drive to discover ways to enrich their teaching. Ten percent considered themselves in the Age of Stability, when their careers have reached a plateau and they did not have much interest in professional development. Six percent chose the Stage of Career Frustration, with the teachers wondering why they were still in the profession, and five percent identified themselves as in the stage of Career Wind-down, ready to leave teaching. Five percent did not identify themselves with a stage.

Open interviews were held with 50 of the teachers randomly sampled from the entire group to validate the data collected on the questionnaires. The teachers at the Frustration stage had the lowest mean scores on the instruments, while teachers at the Enthusiasm and Growth stage and Competency Building had the highest mean scores. The data showed a gradual positive increase in teachers’ attitudes toward educational change between the
Induction, Competency Building, and Enthusiasm and Growth stages, but there was a gradual decline after the Enthusiasm and Growth stage. Maskit concluded that the teachers’ stages of development affected how open they were to implementing new methods and strategies. The teachers who were well-established and excited about their careers were more willing to embrace change, whereas in the unsettled beginnings and the frustrating ends of their careers, teachers were not focused on implementing change.

This research study supported the premise that younger, more open teachers were likely to be the conveyors of educational change. The description of the teaching stages contributed to the understanding of why some younger teachers are able to adapt to change. Mid-career teachers who were successful and confident were the ones most likely to implement pedagogical change, such as inquiry learning.

**Teacher Emotions**

Education is a profession that is subject to frequent, mandated change. One of the salient factors related to change is teachers’ emotions. When asked to implement change, teacher emotions ranged from hope to fear, according to the literature. Although teachers sometimes expressed fear, they were generally willing to follow through and do what was asked of them in regard to the change.

A three year, qualitative research study was conducted in China by Lee and Yin (2011) during a period of educational reform. The researchers examined the role of teacher emotion during educational change in Guangdong, one of the first four provinces to implement the new state curriculum. They employed an embedded case study approach, and both the teachers and the schools were included as units of study. Three schools were selected from the upper, middle, and lower levels of secondary schools in the province.
Twenty-two teachers and administrators participated in semi-structured interviews. They were asked about the impact of the new curriculum on their emotions, if there were any occurrences that made them feel joyful or sad while using the new curriculum, and if there were any changes in their feelings about the curriculum over the three years, and if so, to explain why. In addition to the interviews, teachers kept reflection journals to capture their experiences with the reforms. Some teachers also kept personal blogs and participated in an on-line discussion.

The researchers found that teachers often experienced positive and negative emotions simultaneously. Emotions were not coded as positive or negative because of their concurrent status. Some descriptors used by informants included “happy and scared,” and “hopeful and anxious” (Lee and Yin, 2011, p. 32). Anxiety and worry about the new evaluation process that accompanied the new curriculum were expressed, along with excitement and hope that the new curriculum would be an improvement. Teachers mentioned frustration with the constant string of reforms imposed on them, but they were willing to implement the change. No teachers were completely positive or negative about the new curriculum, but all articulated multiple, overlapping emotions.

As the study progressed, the teachers shared that they felt stressed, tired, and confused by the new methods. They felt like they were not in control of the teaching or the classes. The teachers did not like the new hands-on, inquiry-based lessons because it took so much instructional time and they were not able to teach all of the information needed to pass the province examination, which was considered a reflection of the schools’ effectiveness. Over time, Lee and Yin identified three groups of teachers: the “losing heart accommodators” who wanted the reforms to be successful but lost heart as they became
confused about how to implement the new curriculum, but continued to try despite loss of confidence; the “drifting followers,” who also started out somewhat excited about the curriculum changes but felt left out and like helpless by-standers who did as they were told; and the “cynical performers” who held strong opposition to the reforms but implemented them out of obedience (Lee & Yin, 2011; p. 36).

Lee and Yin concluded that there was a need for the inclusion of teacher input for proposed changes, emotional support and safety so that teachers could cope openly with change, and follow-up support when implementing a new curriculum. They indicated a need for improving relationships within the schools, providing positive ways for teachers to communicate with each other, and helping teachers to become responsible for improving their own practice.

This study acknowledged that teachers have emotional responses to educational change. Top-down reforms generally ignored the impact on teachers. The teachers in this study cared about their students and tried to be open to the new reforms at first. Over time, however, they became disappointed and lost confidence in themselves as teachers because there was no follow-up support. The suggestion to include teachers in planning reforms is critical to teacher acceptance of change and the ability to implement it. Lee and Yin (2011) suggested inclusion of teacher input when change is being contemplated, and this would extend to helping teachers transition to more frequent inquiry teaching. Only when teachers feel truly involved and supported will they be able to embrace the use of inquiry, which is a complicated and sophisticated teaching style (Meyer & Avery, 2010).

Teachers experience change constantly throughout their careers. A research study by Hargreaves (2004) investigating teachers’ emotional reactions to change agreed with Lee and
Yin’s (2011) study by recommending teacher inclusion in the change process. Hargreaves’ study involved 50 Canadian teachers in urban, suburban, and rural schools at both the elementary and secondary levels. Interviews and four focus groups were conducted to discover the emotional responses of teachers in the midst of change. The teachers were chosen by the principals in their schools, and care was taken to include a wide range of age, mixed gender, minorities when possible, and different orientations to change.

Each interview lasted from 60 to 90 minutes and covered the topics of teacher emotion as it related to change, teaching, and professional development. It was found that 60% of the teachers viewed change as externally mandated, and 58% perceived change as negative. Several teachers understood change as a dichotomy; either desirable self-initiated change, or undesirable mandated change. Twenty-five percent of the teachers spoke of repetitive mandated change and its detriments, and the focus groups expressed cynicism because change seemed constant. Many teachers thought that if they could outlast the change, they could continue teaching the way they always had. Younger teachers were more likely to see change as a positive force than older teachers who had been teaching longer. In fact, 22% of the sample saw educational change as an opportunity to learn and grow, and to help students to learn better.

Several themes emerged from this study. First, mandated educational change is routinely perceived as negative by teachers. Second, self-initiated change is perceived in a positive way, even if it is based on mandated change. Hargreaves noted that mandated or self-initiated change may not be the problem; rather exclusive or inclusive change may hold the key to improving teacher acceptance of change. Third, teachers who are positive about mandated change tend to be female, young, teaching subjects other than basic content (such
as guidance counselors, music or art teachers), and working in innovative instead of traditional schools. Hargreaves concluded that top-down change must involve teacher input and respect teachers’ professional opinions. Teachers must be made part of the team when change is planned for change to be successful.

In the face of mandated change, teachers did their best to cooperate, even when they were not included in the decision making process. However, successful, transformative change was effected when teachers were included in planning educational change. This study suggests that if teachers are to embrace inquiry education, they should be included in planning for its implementation.

Resistance to Educational Change

Sannino (2010) conducted a study in Italy that researched teacher resistance to change. Sannino maintained that although most people see resistance as a barrier to change, it can actually lead to teacher agency, allowing teachers to lead the change and develop a sense of responsibility for the shift in practice. Sannino investigated the process of experiencing as it related to teachers and educational change, stating that it “creates favorable circumstances for teachers to engage in transformation and innovation” (p. 838). The theory of experiencing, which explains how people deal with critical difficulties in their lives, is defined by its author, FyodorVasilyuk (1988), as “the direct sensation or experience by the subject of mental states and processes. We propose to use this term to denote also a particular activity, a particular internal work, by means of which a person overcomes and conquers a crisis, restores lost spiritual equilibrium, resurrects the lost meaning of existence” (p.10).
For Sannino’s study (2010), the principal of a high school invited her to implement a teacher intervention called the Change Laboratory. This process was designed to help teachers overcome issues with classroom management and assessment procedures. In this Italian high school the teachers individually evaluated students by asking oral questions. The rest of the students in class were expected to sit quietly and listen while awaiting their turns. This caused difficulties in classroom management because the students not being questioned did not sit quietly, pay attention, and often did other things while waiting. The intervention lasted for three months and involved 12 teachers who taught classes of 30 students.

The researcher began by observing and interviewing the teachers and the students about their impressions of classroom management. The next step was to hold two-hour meetings with the teachers every second week, during which the teachers would discuss their problems and try to find solutions. They would implement the changes and attend a follow-up meeting to evaluate their modifications. The teachers also wrote autobiographical accounts to help reflect on their practice.

In the beginning, the teachers demonstrated hostility as they complained about the government and high-level administration. They were also hostile toward the Change Laboratory intervention. The researcher used teacher meeting times to help them reflect on their practices and to discuss their management problems in terms of learning theory. These activities encouraged a different way to talk about problems without complaining, and eventually the teachers found more productive ground to engage in conversation around the change process. Engaging in this reflection caused teachers to go beyond their defenses and begin to sort out the barriers and solve them.
Sannino (2010) concluded that if, over time, teachers were encouraged to find ways to experience conflict in productive ways, their thinking and attitudes about change could lead them to reflect on and acknowledge their personal limitations. This would push teachers to work together to design their own change. Sannino’s research found that teachers involved in the change process may experience some discomfort, but will ultimately accept the changes and take responsibility for their success.

**Teacher Experiences with Inquiry as Students**

One factor that may affect teachers’ decisions whether or not to use inquiry-based learning is their personal experience using inquiry methods as students in school. Most of the literature in this area concentrated on preservice teachers who were learning to teach science. In the review of the literature, it became clear that much of the reluctance of preservice teachers, student teachers, and in-service teachers to try inquiry methods had to do with their beliefs about the nature of science and how science should be taught. Because of the sort of information needed to understand this topic, the data in most of these studies were derived from qualitative or mixed methods.

Many studies from across the world have researched teacher training and its relationship to inquiry use in the classroom. Most researchers agree that teacher exposure to and experience with inquiry-based learning can lead to improved instructor attitudes about science teaching and inquiry. Teachers who have experienced inquiry learning, have seen it modeled, and who have support implementing it are more likely to employ it in their own classrooms (Blanchard & Granger, 2008; Byman, Krofkors, Toom, Maaranen, Jyrhama, Kynaslahti, & Kansanen, 2009; Hogan & Berkowitz, 2000; Schwarz, 2009; Tessier, 2010).
An example of this research was a study conducted in 2008 by Blanchard and Granger. The purpose of the study was to discover whether or not teacher participation in a research experience of their own would translate into inquiry teaching in their science classrooms. A purposeful sample of four secondary science teachers of grades 9 through 11 attended a six-week marine biology inquiry science activity in which they did actual research and learned to use inquiry as a teaching method. The teachers came from four different schools in Florida, and they had four to eight years of teaching experience. Two of the schools were predominantly Black with a large number of students receiving free or reduced lunch; the other two schools were predominantly White with a low number of students receiving free or reduced lunch. A scientist led the summer research experience.

The teachers filled out a questionnaire, then were observed and interviewed. The observations were rated on the level of use of inquiry using the Science Teacher Inquiry Rubric (STIR; Bodzin & Beerer, 2003). After the program was implemented, the STIR data showed that three of the four teachers were focusing on having the students design and conduct experiments, and much of the inquiry was guided.

The data were coded according to the Teacher/Learner Inquiry Continuum developed by Blanchard (2006). The types of questions posed by teachers and students pre- and post-program were examined. All four teachers demonstrated evidence of moving toward more learner-centered lessons; for example, pre-program, 97% of the questions were asked by the teachers, and post program 83% of the questions were asked by the teachers. The number of higher order questions also increased following the training. For example, one teacher’s students asked 0% higher order questions prior to the program, and post program 39% of the questions posed by the students were higher level. Also, there was an increase in procedural
questions asked by the teachers, indicating their awareness of the importance of the inquiry process.

Another finding was that if inquiry processes were perceived by the teacher to interfere with test preparation, teachers would not use it very often. The students were required to do well on the state tests, and teaching content was paramount to their success. Inquiry is not as efficient as lecture, and it takes more time to implement. Therefore, when it came to test preparation, the teachers were more concerned with teaching enough content instead of using a variety of teaching methods.

The context of this study is important to understanding teacher use of inquiry because it demonstrated that teachers’ experiences with inquiry learning may impact their choice of instructional methods. Many times, professional development provides pragmatic training without a clear understanding of the theories which underlie it. Discussion about learning theories can lead to reflective thinking, as was revealed in this research. If teachers understand the theory behind their practice, they may try to apply it to their practice and design more thoughtful, effective instruction, including inquiry lessons. Explaining what teachers are expected to learn, and why, prior to professional development training would possibly prepare them and perhaps make them more open to learning new strategies.

Another factor in this study was that the teachers invested six weeks in the summer, most likely on their own time, to participate in the marine science inquiry program. Yet even after training, designing and implementing their own lessons, and discussing the videotapes and interviews with the researchers, only two of the four teachers decided to continue with inquiry as a teaching method.

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A research study by Choi and Ramsey (2009) sought to discover in-service teachers’ beliefs and attitudes toward inquiry-based science instruction. Because teachers tend to teach the way they were taught (Eriksson, 1997; Phelps & Lee, 2003; Stuart & Thurlow, 2000), the researchers wanted to determine if teachers’ science teaching practices would change after taking a science course designed to introduce them to inquiry-based learning. The participants consisted of 14 in-service teachers enrolled in an elementary science methods course that stressed the use of inquiry strategies. Eight of the subjects were elementary education majors and six were education majors in content areas such as English, history or physical education. Their teaching experience ranged from 0 to 20 years. The teachers’ experiences with science courses varied greatly, from no science courses at all to more than 10 courses.

A mix of qualitative and quantitative data were collected and analyzed. The qualitative data consisted of semi-structured interviews, observations of the practice teaching performance, lesson plans, and teachers’ reflection journals. The interviews probed four areas concerning inquiry methods: teachers’ prior knowledge, beliefs, practical knowledge, and practice. The researchers used the Reformed Teaching Observation Protocol (RTOP; Sawada, Piburn, Judson, Turley, Falconer, Benford, & Bloom, 2002) to analyze teaching performance during their observations. The qualitative data were analyzed by the constant-comparative method and triangulation.

Quantitative data were collected though the administration of the Revised Science Attitude Scale (RSAS; Bitner, 1984; Thompson & Shrigley, 1986). The RSAS consisted of 22 Likert scale items. The scale was given to the teachers before and after the course. The
survey responses were analyzed by finding the percentage of teachers responding with disagreement, agreement, or neutral answers.

Prior to taking the science methods course, most teachers expressed that they had no opinion about inquiry-based learning because they had never experienced it. The pretest scores indicated negative feelings about teaching science in general; 86% of respondents signified reluctance to teach science, and 79% said they dreaded it. A majority of teachers (71%) did not believe they had enough content knowledge to teach science through inquiry-based instruction prior to the course. After the course, all of the subjects understood the concept and approach. The majority of the teachers indicated positive attitudes toward inquiry-based instruction on the RSAS posttest (86%).

During the course, 86% of the teachers attempted inquiry-based lessons in their own classrooms. Despite their openness to trying inquiry-based learning, the teachers noted that the method took too much time and preparation, and was difficult to assess. The researchers concluded that for teachers to teach science through the inquiry method, they must be better prepared in their preservice courses, both in science content knowledge and in the use of effective methods such as inquiry. They believed that the teachers most likely needed more time and experience with science teaching and inquiry methods before they could implement them with confidence.

Several other researchers also came to the conclusion that preservice teachers must learn science through inquiry methods themselves to be confident using them in their future classrooms (Kazempour, Amirshokoohi, & Colak, 2009; Liang & Richardson, 2009; Varma, 2007). A dissertation study by Varma (2007) investigated the effects of a science methods course and field experience on preservice elementary majors’ confidence to teach science.
The sample consisted of 40 female college students in their junior or senior years. They were all enrolled in a science education methods course designed to help preservice teachers translate theory into practice. During the course, the teaching majors were placed in grades four or five in public schools, and paired with in-service mentor teachers. The student teachers did not teach in the classrooms, but they observed and assisted at times. They spent two hours a week for 12 weeks in the field. Five focus group sessions with a semi-structured interview format were audio-taped and transcribed. The information gathered at these sessions served as the primary data source.

A researcher-developed questionnaire, called Study Specific Questionnaire (SSQ; Varma, 2007), was administered to ascertain the preservice teachers’ perspectives on inquiry and confidence in teaching science after the course and field experience had concluded. Fourteen items were designed to examine the preservice teachers’ understanding and knowledge about inquiry-based education, three items for confidence to teach, and three items about perceptions of content taught in the methods class compared to what was observed in the field.

A second instrument, Science Teaching Efficacy Belief Instrument (STEBI-B; Riggs & Enochs, 1990) was used to confirm preservice teachers’ self-efficacy beliefs. STEBI-B consisted of 23 items on a 5-point Likert scale, ranging from strongly agree to strongly disagree. Thirteen items were intended to address the preservice teachers’ confidence, and 10 questions assessed how much they believed that their teaching would positively affect student learning.

Reflections in the focus groups revealed that by the end of the course and field experience, the preservice teachers thought the course facilitated their understanding of
inquiry education. The SSQ confirmed these data. It was found that 72% of the preservice teachers understood the connection between the course and the field experience, and at the end of the study, only 9% still had negative feelings about inquiry use and science teaching. A portion of the group still felt uncertain about using inquiry methods (19%), perhaps because they needed more experience with new strategies.

A further finding was that the preservice teachers gained confidence in using inquiry and teaching science by the end of the course and field experience. Many of them expressed a desire to learn more about science content. Most preservice teachers expressed confidence to teach science (64%). Some were not confident (12%), and almost one-fourth of them were still uncertain (25%). In personal teaching efficacy, 76% were positive, 7% negative, and 18% uncertain. In the area of science teaching outcome expectancy (believing that teaching exerts a positive influence on student learning), 61% believed that teaching could have a positive effect on student learning, 39% thought teaching did not influence student learning, and 28% were uncertain.

One of the few studies about teacher experience with inquiry that explored a content area other than science was conducted by Kohlmeir, Saye, Mitchell, & Brush (2011). The research concerned teaching historical content through problem-based historical inquiry (PBHI). The researchers investigated the dilemma of whether low-achieving students are capable of learning content from inquiry-based lessons in social studies. They mentioned that many teachers do not believe low-achieving students are capable of conducting inquiry, thus do not use it with them. Kohlmeir, et al., (2011) contended that most teachers have never experienced inquiry learning as students, and so may hold beliefs that inquiry is too open-ended for low achievers who may need more support to learn. The researchers also
asserted that as inquiry facilitators and mentors, some teachers may not realize that they are expected to provide support and background knowledge to students during the investigation. The project centered on two principles: the units were designed around ill-defined problems so that students needed to evaluate evidence and defend their ideas, and “students’ exploration is supported through deep content research, embedded disciplinary expertise, teacher probing, multiple perspectives, multiple intelligences, and collaboration” (p. 59). Six mentor teachers were trained in PBHI instruction by the researchers. They planned a PBHI unit and met in groups to discuss the process and reflect on the lesson plans. The six mentor teachers were paired with teachers who taught their low-achieving students through traditional methods. The article focused on one team’s experience with the PBHI method. The participants attended a summer workshop during which they planned two lessons using PBHI, participated in a bi-weekly forum, and taught and evaluated the lessons. Lessons were planned using the question, “When is the government justified in limiting civil liberties?” (p. 60).

The mentor teacher of the team had taught sixth grade modern history for 15 years. The mentee teacher had taught social studies in grades 7 through 12 for 15 years. She was very interested in the inquiry process, but expressed fear of chaos in the classroom, and concern about the difficulty of learning for her students. She had tried inquiry-based learning with her advanced students, but thought that regular and low-achieving students would not succeed due to poor reading skills, lack of motivation, and disinterest in the topic.

Three sources of data were collected for the research study: student written work and videotapes of lessons; transcripts of the teachers’ planning sessions, online journals, and pre- and post-study interviews and reflections on the implementation of the unit; and the
researchers’ online journals and transcripts of their meetings. The researchers analyzed the data and identified the following categories: challenges faced by the teacher and student; meeting the challenges; and shifts in thinking. The final themes determined by Kohlmier, et al., (2011) were role of the teacher, view of history, and view of students.

In their findings, the researchers learned that the mentee teacher had shifted her view of her role from provider of knowledge to a constructivist view. Her desire was to teach her students to investigate and decide what they believed the truth about history to be. The mentee teacher devised a scenario to motivate her students. She told the students that an announcement was imminent that a mandatory breathalyzer test would be performed at the prom. The class discussed the fairness of the decision, and then the teacher related the scenario to the historical incident she wanted the students to investigate. Using an authentic problem to which students could relate made them care about solving it.

The teacher modeled how she wanted the students to present their findings (using the first person when speaking from the historical character’s perspective). Feedback was given to the students as they prepared their presentations to assist them in refining their work. In the process, the teacher learned the importance of scaffolding learning. To help the struggling readers, the researchers wrote parts for them, and the teacher insisted on embedded comprehension questions to provide the opportunity for students to think about and understand their characters. Embedded questions were chosen over a list of questions at the end to avoid boredom and to allow students to stop periodically and consider what they had read. The learners were successful with this method.

The researchers found that the mentee teacher also shifted her view of history. She began to understand that history is not merely a set of facts, but is open to interpretation
based on primary sources. She also realized that she needed to have higher expectations of all of her students, including the low-achievers. The students were motivated and saw the purpose of the lesson, which she noticed was a change from the boredom they usually exhibited in class. The mentee teacher thus changed her view of the students as well; she found that all students are capable of higher-level thinking.

This study was chosen for inclusion in this review of the literature for three reasons. One was the fact that it involved in-service teachers. Almost every study about teachers and inquiry experience was about preservice teachers. Another reason was that it concerned history instead of science. It seems that research about inquiry practice revolves mostly around science teaching, and it was notable that inquiry learning was implemented in history with PBHI. The most compelling reason for including this article was that it challenged the idea that inquiry-based education can only be used with adept students. In fact, the opposite was true; low-achieving students became more motivated to learn and used higher-order thinking skills.

Perhaps with on-going support and professional development, teachers would be able to sustain and refine their attempts at inquiry implementation. Most in-service teachers in these studies had never experienced inquiry learning. If inquiry skills will be crucial to survival in the new millennium, it would make sense to train teachers to begin teaching those skills before they enter their own classrooms.

**Inquiry and Problem-solving Style**

It is possible that the way teachers prefer to solve problems could impact their decisions about what pedagogical methods they use, thus influencing teacher use of inquiry learning in the classroom. In an exhaustive review of the literature, this researcher did not
find articles or studies devoted to the relationship between problem-solving style and instructional decision-making. This current research study is the first to investigate a possible connection between the two constructs. Because the process of inquiry learning incorporates problem-solving and creativity, there may be a link to problem-solving style. The discovery of common problem-solving traits among teachers who frequently use inquiry may provide insight as to why some teachers choose to incorporate inquiry methods into their teaching, while other teachers do not. A discussion of literature related to problem-solving style ensues.

Early problem-solving style theory was centered on how personality, productivity, and environmental practice were related to a person’s problem-solving style. For example, Kirton (1976) introduced his theory of adaptors and innovators. He believed that adaptors were people who worked within the existing system to solve problems, while innovators preferred to change the existing system and find new, original ways to solve problems. Kirton developed his Adaptation-Innovation Inventory as a method to describe different problem-solving styles. In 1987, Puccio added the concepts of originality and fluency to problem-solving style theory. Fluency was defined as the total number of ideas generated by an individual, and originality was judged by expert opinion on the quality of the idea (Stoyanov & Kirschner, 2007). Puccio found that “innovators were significantly more fluent and original than adaptors” (in Isakson, Puccio, & Treffinger, 1993, p.154).

Isakson, et al., (1993), connected Creative Problem-solving (CPS) with the theory of problem-solving style. They explained their position:

…our goal is to understand better and build more effectively upon the multi-faceted nature of creativity, through interactionist, rather than reductionist, methodologies.
Our goal is to understand the natural interactions among the sources that lead to creative productivity. We believe that too many previous investigators have artificially separated creativity…into separate or isolated topics of study (p. 156).

These efforts formed the foundation for their later work on problem-solving styles. The focus on creativity led to the development of the three dimensions of problem-solving styles that are examined in the instrument, *VIEW: An Assessment of Problem-solving Style* (Selby, Treffinger, Isaksen, & Lauer, 2002). On *VIEW: An Assessment of Problem-solving Style*, the original CPS construct of Personal Orientation became Orientation to Change, Process became Manner of Processing, and Outcome evolved into Ways of Deciding. The intention of CPS was to assist people in the development of helpful problem-solving strategies and to support them in knowingly choosing processes that would be better suited to solving the problem (Isaksen, et al., 1993). Another reason for educators to understand problem-solving styles is to make collaboration more harmonious. Teachers would be recognized for the problem-solving type they embrace and could be matched to problems that are best suited to being solved in a particular style. They could also understand how to collaborate with peers who have similar or different styles.

Stoyanov and Kirschner (2007) used the adaptor-innovator paradigm to investigate the effect of two problem-solving styles on originality and fluency of ideas while solving ill-defined problems. Thirty-four undergraduate students in the Netherlands participated in the research study. The students were divided into three groups: two experimental and one control. The independent variables were problem-solving techniques with two levels: direct and remote. The direct condition gave specific directions on the brainstorming technique. The remote condition involved analogizing solutions to a problem from the participant’s
personal experiences that were not related to the specific problem. The dependent variable was idea generation in terms of fluency and originality. The problem presented to the three groups was a change-management problem in higher education.

The Adaptor-Innovator Inventory (Kirton, 1999) was administered after the implementation of each condition as a posttest. The instrument consisted of 32 items on a 5-point Likert scale. Internal reliability was high ($p < .87$). A second measure, in the form of a questionnaire using a 5-point Likert scale, was administered to determine any differences between the groups in regard to prior experience with the independent variables, conditions during the study, anxiety, and amount of time used.

A MANCOVA was conducted to examine the effect of the variables. Students in the remote condition demonstrated significantly better problem-solving than the other two groups in terms of originality ($p < .02$ for the comparison with the direct group, and $p < .01$ for the control group). There was no significant difference in fluency between the groups ($p < .5$). Linking unrelated experiences through analogy to an ill-defined problem resulted in the most original responses. Experts in the field were recruited to evaluate the originality of the responses. They determined that the direct group generated more responses, although not significantly more, but their ideas were not as original as the remote group.

This study of problem-solving styles relates to inquiry education in several ways. The research utilized a real-life, ill-defined problem as the topic. Even though the students did not pose the problem themselves, they were asked to use the knowledge and skills presented before brainstorming solutions to pose original solutions. The remote group used a variety of roles and perspectives to solve the problem, and the use of analogy allowed the
students to produce a wealth of diverse solutions. Although the students were told how to approach the problem for each condition, the remote condition demonstrated that problem-solving style influenced the quality of solutions. If this is indeed true, then it is possible that teachers can be trained to understand how their problem-solving styles help students solve problems through the use of the inquiry method of teaching. In fact, some colleges such as Penn State Great Valley in Pennsylvania and the University of Missouri have begun offering courses designed to develop strong problem-solving leaders (Jablokov, 2008). The implications of training teachers in this capacity could include the increased use of inquiry pedagogy and the development of stronger problem-solving students in general.

One of the authors of *VIEW: An Assessment of Problem-solving Style* (2007), Edwin Selby, collaborated with John Houtz to enhance the instrument’s construct validity (2009). Philosophically, the authors believed that how people approach or solve problems affects their problem-solving success. People with vastly different problem-solving styles may have difficulty relating to each other and collaborating. They maintained that people would work better with others if they understood various problem-solving styles. To explore this concept, a sample of convenience was obtained at a New York university. The sample consisted of 23 graduate students and 19 undergraduates. There were 29 females and 13 males with an age range of 18 to 35 years. Two subjects were Black, two were Asian, six were Hispanic, and the rest were Caucasian. The students were given *VIEW: An Assessment of Problem-solving Style* and the Problem-solving Inventory (PSI; Hepner, 1988). The PSI consisted of 35 items with a 6-point Likert scale. The instrument measured an individual’s “perceived confidence, self-efficacy in problem-solving, an individual’s seeming approach or
avoidance style in problem-solving, and an individual’s perceived sense of personal control over his or her emotions or affective process during problem-solving” (Hepner, 1988, p. 21).

In addition to the two measures of problem-solving style, a subscale of the Torrance Test of Creative Thinking (TTCT; Torrance, 1974), Thinking Creatively with Pictures, was administered. The assessment consisted of three activities in which people are timed as they draw lines, markings, shadings, and other details to complete incomplete designs or figures. Scores are given for the number of details and drawings completed (fluency), how unusual the drawings are (originality), and resistance to closure, in which the scorer decides if the respondents demonstrate a deeper searching or thoughtfulness.

Using information from the PSI, the researchers theorized that individuals with the avoidance style may be more resistant to closure, unwilling to quickly accept a solution to a problem, and resistant to continuing to seek a better solution. Approach-oriented people work to solve the problem quickly. Therefore, problem-solving might seem more arduous to avoidant people.

The results of VIEW: An Assessment of Problem-solving Style (Treffinger, et al., 2007) demonstrated that Explorers, as compared to Avoiders, are not willing to give up easily and tend to push out of the box. This would indicate that Explorers do not avoid solving problems, but they may take longer to complete the process. In addition, the VIEW: An Assessment of Problem-solving Style results indicated that People-oriented Decision-makers were more likely to solve problems only after considering how their actions would affect others. People eager to finish their work quickly may select a different, more convenient solution.
Selby and Houtz (2009) continued their analysis by pointing out that people with different problem-solving styles may match a certain type of problem, while other styles may cause a mismatch. The environment must be compatible with the problem-solving styles of the people who occupy it to ensure success. Knowledge of problem-solving styles allows for manipulation of the environment to help an individual improve performance.

**Summary**

Inquiry-based learning has been identified as an effective method for the development of critical thinking, creativity, collaboration, and the ability to pose and find answers to questions, which are among the 21st Century Skills needed for students to succeed in a global economy (Brown, 2009; Darling-Hammond, 2007). There was considerable support in the literature for investigating the catalysts and barriers to teacher use of inquiry. Three theories supported the importance of inquiry learning. They included the theories of constructivism (Dewey, 1910), planned behavior (Ajzen & Fishbein, 1980), and mindset (Dweck, 2006). Teachers’ beliefs and the methods they experienced in school as students appear to influence instructional decision-making (Eriksson, 1997; Phelps & Lee, 2003; Stuart & Thurlow, 2000). Also, the teacher’s role in change, such as the implementation of an unfamiliar pedagogy, may influence how that change is accepted by the individual (Hargreaves, 2004; Lee & Yin, 2011). These factors have never been examined together in one study to reveal how they might influence teacher instructional decisions. Problem-solving style has not been investigated in relationship to inquiry teaching. Moreover, many studies on inquiry and its implications have been conducted in foreign countries, and fewer have been conducted in the US. Therefore, this research study will add to the body of knowledge about possible catalysts and barriers to American teacher use of inquiry methods in the classroom.
The next chapter describes the sample chosen for this study, its research design, instruments, and the methods employed. A qualitative methodology was chosen to enable the researcher to investigate and discover the answers to the research questions, which are presented at the beginning of the chapter. This method allowed the researcher to interact with the subjects, and the heuristic approach permitted the interpretation of the responses collected in the interviews.
CHAPTER THREE:  
METHODOLOGY AND PROCEDURES

This section provides a discussion of the design of the study, the researcher’s biography relative to the study, the participants, the data collection procedures, data analysis, permissions, a timeline, an ethics statement, and the limitations of the research study. This qualitative, multi-case study was implemented to examine the phenomena of catalysts and barriers pertaining to teacher use of inquiry-based teaching methods from the unique perspective of the teachers. The following questions were addressed:

1. What are teachers’ understandings and beliefs about teaching and inquiry?
2. What are teachers’ perceptions about educational change?
3. What are teachers’ experiences in using inquiry as students?
4. What are catalysts and barriers to using inquiry methods in the classroom?
5. What are patterns of problem-solving traits among teachers?

Today, it is vital that educators incorporate inquiry to impart the deep knowledge of a topic, along with the many skills required to learn, work with others, problem-find, and problem solve in the 21st Century. These skills are crucial if students are to be adaptable to the changing economic realities of the future (Brown, 2006; Connecticut State Department of Education, 2010; Darling-Hammond, 2007). Therefore, it is critical to understand the catalysts and barriers that teachers experience regarding the use of inquiry (Qablan & Al-Momani, 2009; Shore, Aulls, & Delcourt, 2013). This research study sought to comprehend teachers’ perceptions about using inquiry through a multi-case study to directly observe teachers and gain access to their beliefs, thoughts, and opinions.

A heuristic, hermeneutical perspective was taken to allow the researcher to holistically interpret the interview data, which were transcribed verbatim from a tape
recorder in a dense narrative. The goal of the study was to interpret the data in light of the teachers’ reported experiences through the researcher’s intuition, experience, and self-reflection (Merriam, 2009). The use of several different methods of data collection afforded the researcher opportunities to clarify and explore related concepts as they emerged (Lincoln & Guba, 1985). Multiple methods of data collection also provided a means for triangulating data to present a multi-dimensional aspect to the study and to more deeply understand teacher perceptions of catalysts and barriers to frequent use of inquiry instruction.

**Design of the Study**

This study utilized an interpretive qualitative paradigm (Creswell, 2007) in the form of a multiple-case study. Figure 1 illustrates the salient characteristics of this design. A hermeneutical approach allowed the researcher to interpret the results in the light of their context as revealed by the informers. This was valuable because the case studies were used to illuminate understanding by discovering the catalysts and barriers heuristically through the teachers’ and the researcher’s experience (Merriam, 2009). This method was chosen to discover, describe, and interpret the essence of the experiences reported by the informants (Creswell, 2007). The design employed semi-structured interviews to comprehend teachers’ perceptions and understandings as they affected teacher use of inquiry, observations of participants to verify their reported teaching styles, a problem-solving styles assessment. Discourse coding, recoding, and data analysis (Bilken & Casella, 2007) were part of the qualitative design. It was critical to use this type of qualitative design to observe, interview, and interact with the subjects to gain their trust in order to obtain the most honest and accurate information possible.
Researcher Biography

The investigator has had a long-standing interest in teacher use of inquiry due to her personal success in motivating and engaging students while using this methodology. She taught third grade for 15 years and implemented inquiry in math, social studies, reading, and science for 14 of these years. In the second year of teaching third grade, the researcher was invited to team-teach with a colleague who implemented inquiry techniques, and the result was a fortuitous education on the format and effectiveness of student inquiry. The inquiry lessons varied along a continuum according to student needs, from structured, to guided, to open inquiry (Martin-Hansen, 2002). Guided inquiry was employed more often than the other types of inquiry, but structured inquiry lessons were utilized to teach the students how to conduct investigations. The result was that unmotivated students demonstrated more interest in school, and asked what the class would be doing on a daily basis. The students
shared that they looked forward to coming to school, and they took their roles as researchers very seriously.

For example, every year the students were expected to choose a topic of interest, formulate questions about what they wanted to learn, plan how to obtain the information, organize the information (such as on index cards or in a notebook), research the topic, and design a presentation of their choice to share what they had learned. The students who were capable of conducting open inquiry without much help were allowed to work on their own, meeting occasionally with the teacher. Some students needed guidance and assistance locating appropriate materials, and a small group needed structured inquiry to help them complete their investigations successfully. This activity occurred over the course of a year with close mentoring by the teacher. The year-long projects were displayed in either a learning fair or a museum in the classroom. Parents, other class members, and administrators were invited to attend and to question these new experts. All of the students, including English language learners and special education students, were able to complete the investigations successfully with varying degrees of help. Other inquiry units were also incorporated through the year in math, social studies, and science. For instance, after some direct instruction to impart enough background knowledge, the students performed experiments in science and discussed the findings, their perceived meanings, and the variables that affected the outcome.

The students demonstrated creative thought during a unit about insects in science, a content area the researcher loved teaching. Students worked in pairs or small groups and discussed their work. They were given some background knowledge about insects in general. Next they were given some mealworms to house and feed. Different foods were
suggested by the students and fed to the mealworms. After trying a variety of foods, the students learned that mealworms will eat most types of grain, but not kernel corn or other vegetables. The students also brainstormed different kinds of homes that they thought the mealworms would prefer. Then the students constructed different kinds of homes for the mealworms, including a cardboard box lined with newspaper, a box with branches and leaves, a box with rolled clear acetate tunnels, and a box with shredded newspaper. The mealworms preferred the shredded newspaper or branches and leaves, and they greatly disliked the clear acetate tunnels. As the students discussed the reasons for these effects, the classroom was lively with action and arguments. At the end of the study, the students concluded that the “mealworms must have small mouths because they only like little food and not chunks,” and that “mealworms like to hide because maybe they are nocturnal.” These conclusions were drawn from the students’ observations and discussions, not from direct teaching. After conducting some research to check their thinking, the students learned that mealworms eat small grains, and they are not nocturnal, but like the darkness because they are safer from their enemies.

This investigator observed that the quality of student and teacher discourse improved, with ample evidence of students’ higher-order thinking skills. Creative student thought emerged as shown in the quality and variety of products and findings generated at the end of each unit of study. The researcher based her definition of creative thought on the Association for Childhood Education International (ACEI) position paper (Jalongo, 2003), which states

…it is ACEI’s position that creative expression depends not on talent alone, but also on motivation, interest, effort, and opportunity. The creative process, contrary to
popular opinion, is socially supported, culturally influenced, and collaboratively achieved (p. 217).

The students had worked in small groups to discuss and plan what their mealworms should eat, and what type of house they wanted to construct. They demonstrated motivation, interest and effort as they collaboratively predicted what they thought the results of their choices would bring. All of the student groups wrote laboratory reports that they generated themselves to explain their thinking and record their results.

Over the course of time, the investigator noticed that despite repeated efforts to assist other teachers to implement inquiry, her colleagues expressed little interest in changing their teaching practices. Some teachers criticized inquiry as taking up too much time or being too much work. Because the students involved in inquiry exhibited more interest, excitement, and demonstrated deep understanding of their topics, the researcher was puzzled as to why other teachers did not appear to value that method. Therefore, the researcher developed an interest in why some teachers embrace inquiry enthusiastically, and why many avoid using it at all.

Methods and Procedures

Communities

Administrators in eight school districts in the northeastern US were contacted to participate in this study. Five schools expressed interest and were sent a survey to gather data about teaching styles (see Table 1 for demographic summary). The size of the towns’ populations ranged from 1,265 to 34,726. The population distribution by race was very similar in all towns, with an average of 95% Caucasian, .83% Black, and 4% Hispanic. The average annual household incomes ranged between $62,107 and $121,741. The survey,
Survey to Identify Teaching Styles (SITS), was distributed to all interested third and fourth grade teachers who had at least five years’ teaching experience. All of the surveys were collected about a week later.
Table 1

*Summary of Community Demographics for Research Study Participants*

<table>
<thead>
<tr>
<th>District</th>
<th>Population</th>
<th>Square Miles</th>
<th>Average Annual Family Income</th>
<th>Major Occupations</th>
<th>Ethnicity (Percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>District A</td>
<td>8,500</td>
<td>57</td>
<td>$77,121</td>
<td>Construction</td>
<td>White: 94</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Educational services</td>
<td>Black: 0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Professional</td>
<td>Hispanic: 3</td>
</tr>
<tr>
<td>District B</td>
<td>27,121</td>
<td>64</td>
<td>$62,107</td>
<td>Educational services</td>
<td>White: 90</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Professional</td>
<td>Black: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hispanic: 6</td>
</tr>
</tbody>
</table>
Table 1

Summary of Community Demographics for Research Study Participants (continued)

<table>
<thead>
<tr>
<th>District</th>
<th>Population</th>
<th>Square Miles</th>
<th>Average Annual Family Income</th>
<th>Major Occupations</th>
<th>Ethnicity (Percentages)</th>
</tr>
</thead>
<tbody>
<tr>
<td>District C</td>
<td>27,560</td>
<td>59</td>
<td>$109,767</td>
<td>Manufacturing</td>
<td>White: 98</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Professional</td>
<td>Black: 0.24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Construction</td>
<td>Hispanic: 0.24</td>
</tr>
<tr>
<td>District D</td>
<td>5,104</td>
<td>23</td>
<td>$121,741</td>
<td>Construction</td>
<td>White: 93</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Finance</td>
<td>Black: 70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Professional</td>
<td>Hispanic: 4</td>
</tr>
<tr>
<td>District E</td>
<td>24,638</td>
<td>35</td>
<td>$113,455</td>
<td>Finance</td>
<td>White: 90</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Professional</td>
<td>Black: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Retail</td>
<td>Hispanic: 4</td>
</tr>
</tbody>
</table>
Data Collection

Types of data. Multiple forms of data were collected from the informants in the study to contribute to the understanding of why some teachers embraced inquiry and others avoided it. The entire sample of selected teachers continued in the study throughout the data collection process. The teachers served as human instruments as they reported their experiences (Lincoln & Guba, 1985). The data were collected by means of a survey to identify teaching styles, semi-structured teacher interviews, classroom observations (rated on a rubric), and administration of a problem-solving styles assessment. After completing SITS (see Appendix B), the teachers were observed and underwent a one-hour, semi-structured interview, which allowed the researcher to investigate teacher perceptions of inquiry in depth within the framework of the constructs identified as pertinent to this study (refer to Appendix C for the interview questions). Each teacher was observed for one hour using the EQUIP rubric (Marshall, Horton, Smart, & Llewellyn, 2008; see Appendices D and E) to validate their use of either direct instruction or inquiry. Finally, a problem-solving style instrument, VIEW: An Assessment of Problem-solving Style (Treffinger, Selby, Isaksen, & Crumel, 2007; see Appendix F for more information on the problem-solving styles model), was administered.

All data were triangulated to establish trustworthiness. In addition to the data collected, the researcher kept a pen and paper reflexive field journal to bracket her views on inquiry use, provide an audit trail, record teacher behavior, and provide evidence of the researcher’s ideas and theories related to the study. At the conclusion of the study, the data were audited by an assistant principal with a doctorate in education who had studied
qualitative research and completed his dissertation on inquiry. The purpose of the audit was to verify the codes and themes that were identified by the researcher.

Instruments

**Participants and Survey to Identify Teaching Style**

The teachers who participated in this research were chosen as a purposive sample of maximum variance (Lincoln & Guba, 1985). To understand both catalysts and barriers to teacher use of inquiry, the sample included teachers who used inquiry either frequently or infrequently. To ensure this requirement was met, the researcher designed a survey called *Survey to Identify Teaching Styles (SITS)* to identify each teacher’s level of inquiry use. *SITS* was administered to 40 teachers as the preliminary method of selecting subjects who utilized inquiry teaching either frequently or infrequently. This sample of maximum variance was vital to understanding both the catalysts and barriers to teacher inquiry implementation, because those who frequently or infrequently used inquiry could discuss the catalysts and barriers from very different viewpoints.

*Survey to identify teaching style (SITS).* The questions for the instrument, Survey to Identify Teaching Styles (*SITS*), were compiled using information from experts in direct instruction and inquiry instruction (Rosenshine, 1978; Rosenshine, & Meister, 1995; Saskatoon Public Schools, 2009; Shore, Birlean, Walker, Ritchie, LaBanca, & Aulls, 2009). The 24-item survey was sent for confirmation to a panel of experts from Western Connecticut State University and McGill University. A principal and a reading expert from local public schools also rated the survey in their capacity as instructional leaders. When all of the feedback was returned, only the 16 questions unanimously agreed upon by all seven experts were retained as part of the survey. Based on suggestions from the panel, the
researcher adjusted the wording of some questions, and eliminated several questions entirely, to clearly indicate direct instruction or inquiry. For instance, some questions were eliminated due to the fact that they were not descriptive of one style or the other. Sample items included: I review what students have learned, I use seatwork practice, and I give clear, detailed instruction and explanations. Other items were discarded because the panel determined they were confusing. Sample discarded items included: I use simulations of real world problems in my teaching, and I use independent study to give students the opportunity to investigate topics of interest to them. After revisions, the survey was returned to two of the experts for final approval (see Appendix B).

Once approval for the revised survey was obtained, the final 16-item survey was adopted and used for identification of the final sample. The survey required respondents to utilize a 4-point Likert scale to choose between a more traditional and a more inquiry-oriented approach to instruction. The response format was arranged along a scale ranging from 1 to 4 (1 represented very often, 4 represented rarely) assuming that most teachers occasionally use some form of direct instruction as well as inquiry instruction. This instrument was only employed to gather information about teaching styles for sample selection. It was not validated to calculate sums or means.

Letters of permission were collected from the superintendents and principals for each school before the teachers were contacted to complete SITS (see Appendices G and H). After examining the results of the initial 40 surveys, it was discovered that the instrument had identified teachers who primarily used direct instruction, but not teachers who used inquiry learning as a pedagogical method. Perhaps the instrument was not sensitive enough to identify frequent inquiry-users, or perhaps no frequent inquiry teachers were present in the
original group of 40 teachers. The researcher decided to consult with contacts that were experienced with inquiry to seek out teachers known for practicing inquiry. Those contacts included an advisor and several members of the doctoral cohort who knew or supervised teachers known for implementing inquiry instruction. Several teachers were identified from these sources and selected as a purposive sample (Merriam, 2009). The researcher personally contacted the subjects and asked them to complete SITS. The answers chosen by the frequent inquiry teachers were not significantly different from those of the infrequent inquiry teachers, so the researcher used the recommendations of the expert sources as the criterion for selection. Next, appointments for the interviews and observations were made with each of the teachers participating in this study. Every teacher participating in this study signed a permission letter (see Appendix I).

Adjustments to the criteria. The criteria for participation were that each teacher have a minimum of five years of teaching experience, and currently teach in either the third or fourth grade. However, it was not possible to hold to these stipulations due to the fact that an extensive search did not offer access to teachers representing these conditions. The sample was expanded to allow the survey to include teachers with any amount of experience, as well as fifth grade teachers because some of the frequent inquiry-use teachers were less experienced or taught fifth grade. Therefore, the final sample consisted of two third grade teachers, who had taught between 7 and 23 years, five fourth grade teachers whose experience ranged from 2 to 12 years, and one fifth grade teacher who had taught for 10 years.
Electronic quality of inquiry protocol (EQUIP) rubric. The EQUIP: Electronic Quality of Inquiry Protocol rubric for assessing the quality of inquiry during a lesson is a comprehensive tool that examined many facets of instruction along a continuum (Marshall, et al., 2009). It is available as a paper and pencil instrument, or it can be downloaded onto an iPad as an App. It was chosen because it aligned well with the Martin-Hansen (2002) inquiry continuum. For example, EQUIP: Electronic Quality of Inquiry Protocol provided the categories of pre-inquiry, developing inquiry, proficient inquiry, and exemplary inquiry to rate the level of inquiry in an observed lesson. Martin-Hansen’s scale utilized the categories of no inquiry, structured inquiry, guided inquiry, and open inquiry. The definitions of the categories between the two measures were compatible and easy to match together (refer to Table 2 for alignment). First, EQUIP was used to evaluate the level of inquiry according to the type of activities observed during the lesson. Activities ranged from pre-inquiry (no inquiry observed) to exemplary inquiry (student-centered, students constructing meaning, dialogue between students and teacher, and students actively engaged throughout the lesson). The rubric included codes for type of instructional group, whether whole group, small group, or individual, as well as for student attention to the lesson (low, medium, or high). A cognitive code was used to describe the level of thinking required during the lesson, from non-instructional times to recall, application, analysis, and creative thought. In addition, the instrument was used to assess inquiry-instruction components based on the following five levels: non-inquiry, student engagement, student exploration, student explanation of learning, and extension of learning.

Additionally, an assessment code was used to describe the level and purpose of assessment within a lesson. The continuum ranged from no assessment, to monitoring
student learning, to formative, to summative assessment. Another domain of the rubric analyzed instructional factors such as strategies, order of instruction, teacher and student roles, and level of knowledge acquisition and another rubric to assess discourse factors related to the questioning level and complexity, the communication patterns, and classroom interactions between the teacher and students. Levels of prior knowledge, conceptual development, critical thinking, student reflection, types of assessment (from factual knowledge to authentic measures), and the role of assessment were also rated in the assessment factors domain of the rubric (which was different from the assessment codes).

Finally, the rubric was used to consider curriculum factors, such as content depth, learner centrality, integration of content and investigation, and the manner of organizing and recording information. There was a form at the end of EQUIP: Electronic Quality of Inquiry Protocol to record summative overviews of each domain, and a comprehensive score was obtained by adding the weights given to the levels of inquiry within the rubric (Marshall, et al., 2008).

A panel of experts from Clemson University evaluated EQUIP: Electronic Quality of Inquiry Protocol for face validity, and came to consensus after several adjustments were made. Cronbach’s alpha was used, indicating strong internal consistency ($r = 0.82-0.89$). Inter-rater reliability was moderate to substantial, with Cohen’s kappa averaging 0.61 for the instruction indicators. A confirmatory factor analysis confirmed content and construct validity (Marshall, Smart, & Horton, 2009).

In preparation for the actual observations for this study, the researcher field-tested the EQUIP: Electronic Quality of Inquiry Protocol rubric with two colleagues to achieve rating proficiency (Marshall, Horton, Smart, & Llewellyn, 2008). The researcher observed each
teacher in this study for one hour during the course of the study. The EQUIP: Electronic Quality of Inquiry Protocol rubric was completed during the one observational period. Every five minutes, the observer utilized the rubric to identify how many times inquiry methods were employed by the teacher and the students. The quality and level of inquiry were recorded. Immediately following the observations, the researcher completed the EQUIP: Electronic Quality of Inquiry Protocol and took field notes to preserve the memories, thoughts, and impressions experienced. At no time was there any interaction between the researcher and students in the classroom.

**Teacher interviews.** All teachers in the study underwent an hour-long interview with the researcher. The researcher prepared for the interviews by field-testing the questions with two colleagues prior to the start of the study. Following the field-testing, questions were added or dropped according to participant responses to target the information needed. The final interview process was semi-structured with 40 prepared questions to guide the discussion. The interview questions focused on the following topics: teaching style and teachers’ beliefs, teachers’ perceptions of self, teachers’ perceptions about instructional change, teachers’ understanding of inquiry, teachers’ experiences using inquiry in school, and teachers’ preferred problem-solving styles (refer to Appendix F). However, additional topics emerged and were followed when appropriate to allow the teachers to fully express their thoughts and ideas. All interviews were scheduled outside of instructional time so as not to interfere with teaching and learning. The researcher attempted to make each teacher feel comfortable by explaining that she was investigating teaching styles and would like to have a conversation to learn about the participant’s experiences. Neat, casual dress indicated the researcher’s desire to identify with the teachers, not administrators (Bogdan & Biklen,
The setting was relaxed, and the researcher made a few minutes of small talk before beginning the interview. The researcher also took a moment to reassure each participant that the interview would be treated confidentially (Bogdan & Biklen, 2003).

The interview questions encouraged teachers to reflect on several structured interview topics. Teaching style was discussed in terms of how they developed their teaching style over time, the biggest influence on their teaching, how they implemented direct instruction and inquiry, and how they collaborated with others. Additional questions gleaned information about the subjects’ self-perception as a learner, their attitude toward teaching, and some of their successful and challenging experiences as a teacher. The problem-solving styles assessment, *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007) was completed prior to the interview, and the topic was discussed during a later portion of the interview. The teachers’ experiences with inquiry were investigated by asking about personal experiences with inquiry when they were students in school. The teachers were asked to describe what they believed inquiry meant and how they implemented this form of instruction in their classrooms. They were asked about what made inquiry learning difficult to implement and what would cause them to employ the methodology more often. To better understand the teachers’ perspectives, some questions were reframed as necessary, and probes such as, “tell me more about that,” were used to seek clarification so the essence of what the subjects related would be dependable (Merriam, 2009). Field notes were immediately taken following each interview while the memories and impressions were fresh. There were 40 questions in all, and the interviews were recorded and precisely transcribed by a professional secretary transcription service (Bogdan & Biklen, 2003).
View: An assessment of problem-solving style. A short problem-solving style assessment, *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007), was administered to all participants to reveal whether the teachers’ preferred problem-solving style disclosed common traits among teachers of inquiry. The process of problem-solving is intimately connected with inquiry (Brown, 2006), therefore, the researcher investigated teachers’ problem-solving styles in an attempt to explore whether or not problem-solving preferences influenced teachers’ instructional decisions.

The purpose of *VIEW: An Assessment of Problem-solving Style* is to measure six problem-solving styles among three dimensions: Orientation to Change (OC), Manner of Processing (MP), and Ways of Deciding (WD). Problem-solving style refers to a person’s preferred ways of responding to change. Within the OC dimension, one can be either an Explorer or a Developer. An Explorer prefers to devise new solutions to problems, while a Developer prefers to work with what already exists and try to improve upon it. Within the MP dimension, one’s problem-solving style can be either External or Internal. Some people prefer to share and discuss how to solve a problem with others, while others prefer to work on the problem internally and only share when a solution presents itself. Within the third dimension, WD, one can be either Person-oriented or Task-oriented, making decisions based on the good of the people involved or according to the requirements of the task at hand.

The instrument includes 34 items on a 7-point Likert scale. The instrument is designed for ages 12 to adult. All items are stated in a positive way, and no problem-solving style is considered better than another. The scores indicate the type of problem-solving style preferred by the responder. A moderate score is provided for those who fall between the anchor terms for the styles. Those in the moderate category do not strongly favor either
extreme, but may have characteristics of both problem-solving styles. According to the VIEW Technical Manual (Selby, Treffinger, & Isaksen, 2007), “A reliability study involving stability, as reflected in test-retest results over a one-month interval, was carried out with 48 middle school students and nine adults. The correlations were .90 for the OC, .60 for the WD, and .65 for the MP” (p. 52).

The data for a 12-month test-retest study provide reliability coefficients of .74 for OC, .83 for MP, and .75 for WD, supporting the claim that the instrument is stable and reliable over time. The authors state that factor analyses confirmed the hypothesized factor structure, and that “all items of the VIEW are aligned with their theoretical dimensions” (Selby, Treffinger, Isaksen, & Lauer, 2002, p.236). In addition, the instrument has been found to assess constructs distinctly different from creative thinking ability (Woodel-Johnson, Delcourt, & Treffinger, 2012).

**Reflexive field journal.** Because the data gathered from the subjects was interpreted by the researcher, who was also a human instrument (Lincoln & Guba, 1985), a reflexive field journal was kept to bracket her personal prejudices regarding inquiry use, and record her experiences in the research study. Bracketing, or writing one’s opinions and perceptions of the research topic, allowed the researcher to clarify and recognize prejudices so their effect on comprehending the essence of the informants’ experiences could be recognized, and the researcher could remain as neutral as possible (Merriam, 2009; Miles & Huberman, 1994). Ideas and perceptions were recorded as they occurred to create a written train of thought.

Use of the journal afforded the researcher time to reflect and incubate ideas, and to record moments of illumination. It also provided an audit trail and was audited after its completion. The auditor assessed confirmability, dependability, credibility, researcher bias,
and whether appropriate categories for coding were used by the researcher. Methods were examined to ensure that they were suitable for collecting the desired information. The research findings were confirmed to be grounded in data, and studied to affirm that logical inferences were made. The researcher met with the auditor to discuss the findings, and consensus was agreed upon.

**Analysis of Data**

**Survey to identify teaching style (SITS).** Forty teachers were administered *Survey to Identify Teaching Style (SITS)* to purposely select a sample of maximum variance for this study. Four teachers were chosen for the direct instruction group. The scores among the respondents were close, and none of the candidates stood out as inquiry teachers. The researcher reasoned that either the population completing SITS did not include teachers who practiced inquiry, or the instrument was not sensitive enough to identify inquiry use in the classroom. Because it was necessary to locate a sample of maximum variance, the researcher decided to contact several experts who had conducted qualitative research on inquiry and held doctorates in education from the university. Based upon their recommendations, the researcher purposefully selected five teachers who were known for practicing inquiry.

**Observations.** The results of *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008) were coded and entered into HyperRESEARCH (Research Ware, 2009). The rubric helped the researcher identify how many times inquiry methods were employed by the teacher and the students. Additionally, the facets of inquiry instruction were utilized to provide insight into the quality and level of inquiry during the observation. Frequent and infrequent instances of inquiry use were examined, coded, recoded, grouped into the themes, and interpreted by the researcher. HyperRESEARCH was used in the
coding process for all of the data. HyperRESEARCH is a computerized program that assists in the coding of qualitative data. It contains a study window to view cases, code names and code references. There is a code list editor that stores researcher-generated codes and their definitions. A source code window accepts text, audio, and video data. The program is meant to make the coding, organization, and analysis of data easier than coding, sorting, and analyzing by hand (Zgoda, 2007), although some of the coding was also done by paper and pencil.

The transcripts of the researcher’s notes from each individual observation and interview were entered into the program. Sections of each transcript were then highlighted, and codes were assigned through the Code Book. The Code Book stored all of the researcher-derived codes, making the codes available to use with each individual case. As coding of the individual cases progressed, new codes were assigned to be integrated into themes that emerged. The additional codes were applied to other cases in the recoding process.

**Teacher interviews.** Each teacher was assigned a pseudonym for the purpose of confidentiality. The transcripts from the interviews were entered into HyperRESEARCH (Research Ware, 2009), a computer program devised to assist in qualitative data analysis, to code and group data into emergent themes. Prior to data analysis, the reflexive journal was used to bracket and set aside the researcher’s beliefs about teacher use of inquiry so that epoche, the process of suspending one’s own beliefs to experience the phenomena from the subjects’ viewpoints without imposing one’s own prejudices, could occur (Grbich, 2007; Merriam, 2009; Miles & Huberman, 1994).
Member checking to confirm the researcher’s observations and interpretation of the information reported by subjects comprised of sending individual transcripts to the appropriate teachers to allow them to read the field notes and transcriptions. The subjects were asked to identify errors in factual and interpretive statements, provide statements of concern regarding the transcripts, and to judge the credibility of what was recorded (Lincoln & Guba, 1985). No differences of opinion or inaccuracies surfaced, and the data remained intact.

**View: An Assessment of Problem-solving Style.** The teachers’ responses to **VIEW: An Assessment of Problem-solving Style** (Treffinger, et al., 2007), were scored and reviewed to search for common problem-solving traits among teachers who frequently or infrequently used inquiry. The results of **VIEW: An Assessment of Problem-solving Style** was charted to search for common traits among the teachers. These data were used descriptively in an effort to provide a case perspective of each participant.

**Development of themes.** The data were grouped into distinct, mutually exclusive, descriptive categories as themes began to emerge (Saldaña, 2007; see Appendix K for definitions of the themes and codes that emerged). The categories met the following criteria:

- The categories were responsive to the research questions to insure that all questions were answered;
- The categories were exhaustive so that all relevant data chosen were included in one of the categories;
- Categories were mutually exclusive to avoid overlap of information; each piece of data was included in just one category;
- Categories were sensitive and specific to the topics examined; and
- Categories were kept congruent in concept by charting the data and checking that all items in a category fit together abstractly (Merriam, 2009, p. 185-186).

Reflection on the observations, interview responses, and review of related literature was also valuable in identifying the themes. This analysis led to the interpretation of the essence of the experience for teachers.

A codebook was kept to provide a reference listing and description of the codes (Saldaña, 2007). The use of HyperRESEARCH (Research Ware, 2009) was helpful in this task. Despite the use of a computer, the researcher discovered that some hand coding of the data was necessary, independent of the program. Each case was analyzed and coded separately, then combined with the other data. Once this was accomplished, the researcher used the data to interpret answers to the research questions (Miles & Huberman, 1994).

**Triangulation**

Triangulation by source (third, fourth, and fifth grade teacher participants exhibiting frequent or infrequent use of inquiry in the classroom) sought to corroborate the experiences, impressions, perceptions, and understandings of the two groups of teachers (see Figure 2 for triangulation methods). Reports from the informants were compared to understand if teachers in each group had similar experiences and understandings (Miles & Huberman, 1994).

The use of different methods of data collection (SITS; teacher interviews; EQUIP: Electronic Quality of Inquiry Protocol rubric, Marshall, et al., 2008; VIEW: An Assessment of Problem-solving Style, Treffinger, et al., 2007) furnished information from several different perspectives to view it through a broad lens. Because the catalysts and barriers to teacher use of inquiry were not known, multiple methods were used in anticipation that a deep
understanding could be attained. A contrast and comparison chart was used to triangulate by method, source and data to confirm the accuracy of results (Miles & Huberman, 1994). A relatively small sample size was used to permit time for in-depth interviews and member-checking for dependability. The confirmability audit of the reflexive field journal was another effort to improve credibility (Krefting, 1991).

**Permissions and Timeline**

Letters of permission were sent and received back from the five district superintendents and principals in June, 2011. The districts were informed that the study would take place in the fall of 2011 after the commencement of the new school year. The problem-solving styles assessment was administered when the interviews and observations were carried out in October through December, 2011, and were followed by member-checking. All of the data were collected by the end of February, 2012.
Figure 2.Triangulation of methods.

Hermeneutic approach. A hermeneutic perspective was adopted to allow interpretation of the results. “Hermeneutics is concerned with the interpretation of various forms of communication including speech, dramatic performances, written texts, art, and events” (Grbich, 2007, p. 236). This approach enabled the researcher to explain the meaning of the findings of this research study. The interviews, EQUIP data (Marshall, et al., 2008), and VIEW data (Treffinger, et al., 2007) were analyzed and categorized (Merriam, 2009). The individual codes were later compiled to combine common themes. Part of the data reduction (Miles & Huberman, 1994) included the use of the code-recode method on selected data (Merriam, 2009). The researcher listened to and corrected each transcription to ensure accuracy, and coding began at this time. The codes were revisited to make adjustments where
necessary and data were recoded several times to ensure that the coding represented the findings and answered the research questions (Krefting, 1991; Merriam, 2009).

A codebook was kept to provide a reference listing and description of the codes (Saldaña, 2007). The use of HyperRESEARCH (Research Ware, 2009) was helpful in this task. Despite the use of a computer, the researcher discovered that some hand coding of the data was necessary, independent of the program. Each case was analyzed and coded separately, then combined with the other data. Once this was accomplished, the researcher used the data to interpret answers to the research questions (Miles & Huberman, 1994).

**Ethics Statement**

The researcher received approval from the Institutional Review Board in June, 2011. She holds a valid Human Subjects certificate. All of the participating district superintendents and principals signed permission for the study to be conducted in their districts and schools. Also, every teacher signed permission to participate in the study after being assured of confidentiality. All teachers were informed that not every question had to be answered and that they were free to end their involvement with the study at any time. All identities were assigned pseudonyms to protect confidentiality, and all study-related materials were kept in a locked space in the researcher’s home. No individual teacher identities were disclosed to anyone. At the end of the study, every teacher received a $15.00 gift certificate to a bookstore as a thank you for participation in the study (see Appendix J for timeline and ethics statement).
Limitations of the Study

The sample for this study was purposefully chosen from among volunteers who were either frequent or infrequent users of inquiry. The threat of mortality, or loss of subjects, was minimized by completing all of the data collection in one visit to each teacher.

Truthfulness on the part of the subject is an issue throughout a qualitative study. That is why the interviews were semi-structured. The teachers were made comfortable and allowed to follow their own trains of thought when possible. Triangulation of data through the use of interviews, observations, the results of VIEW: An Assessment of Problem-solving Style (Treffinger, et al., 2007), and member checking, helped to ensure trustworthiness.

Researcher bias is a limitation that exists by the very nature of interpretation. The researcher has to work actively to minimize bias and to adopt the perspective of the subject, while reserving the ability to interpret the results through the lens of her own experience. This was very difficult, but the field journal served as a control for bias, as well as providing space and time for reflection and incubation of ideas (Krefting, 1991).

Because the composition of the sample was fairly homogeneous, generalizability to other school districts is not possible. However, case-to-case transfer can be considered when the conditions of the case are similar to the sample described in this research study (Merriam, 2009). Chapter Four will provide a discussion of the findings of this study, along with a description of the data analysis.
CHAPTER FOUR:

FINDINGS AND ANALYSIS OF DATA

The purpose of this multiple-case, qualitative study was to identify and understand the catalysts and barriers that cause or prevent teachers from implementing inquiry learning in their classrooms. A qualitative approach permitted the researcher to discuss a variety of topics with teachers who used inquiry either frequently or infrequently in their classrooms. These topics included the teachers’ beliefs about teaching, understanding of inquiry, perceptions about educational change, and preferred problem-solving style. The teachers also discussed their ideas about what the catalysts and barriers were that related to their own inquiry use.

The results include the findings from the individual case study observations and interviews, the outcome of the interview findings and observations which resulted in a comparison between the frequent inquiry-use teachers and the infrequent inquiry-use teachers, and the effect of the teachers’ problem-solving style preferences on use of inquiry. Triangulation was accomplished through the use of multiple data sources and multiple methods, and an audit was performed for confirmability.

The following questions were addressed in this research study:

1. What are teachers’ understandings and beliefs about teaching and inquiry?
2. What are teachers’ perceptions about educational change?
3. What are teachers’ experiences in using inquiry as students?
4. What are catalysts and barriers to using inquiry methods in the classroom?
5. What are patterns of problem-solving traits among teachers?
The relevant codes and themes associated with the research questions emerged through the analysis of multiple data sources. Hermeneutics, a philosophy that focuses on interpretation, was applied to this study to allow the researcher to interpret the findings and infer the intended meanings of the subjects’ statements after spending time observing and conversing with them (Merriam, 2009). The individual cases were analyzed through the examination and coding of the observation notes, the results from the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, Horton, Smart, & Llewellyn, 2008; see Appendix K for code definitions), and the interview transcripts. Then the responses from the frequent inquiry-use teachers were compared to those of the infrequent inquiry-use teachers to search for similarities and differences in their perceptions and beliefs about inquiry learning. The catalysts and barriers derived from both groups formed the basis of the answer to research question number four, which was the foundation of this study. The final step was to examine the results of VIEW: An Assessment of Problem-solving Style (Treffinger, et al., 2007) to compare the problem-solving style preferences for both groups.

The results of the research are presented in eight sections:

- A description of each case and subject,
- An account of the interviews conducted with each group based around the groups of questions asked,
- A description of the observations and EQUIP: Electronic Quality of Inquiry Protocol results (Marshall, et al., 2008) as they related to the research questions,
- A discussion about how the teachers were placed in each group,
- The examination of the themes that emerged from the coding analysis,
A discussion of the themes that fell within the internal or external spheres of influence,

A discussion of the catalysts and barriers to teacher use of inquiry, and

A summary of the results.

**Cases and Subjects**

Originally, the researcher designed the *Survey to Identify Teaching Styles (SITS)* for this study to gather a sample of maximum variance that included teachers who were frequent users of inquiry, and teachers who did not use inquiry frequently. The instrument was functional for identifying teachers who used direct instruction as their primary method; however, it did not discern teachers who used inquiry methods frequently, possibly because none of the teachers who completed the survey were frequent inquiry users. It became apparent that a different procedure would be necessary to identify frequent inquiry-use teachers. Therefore, the researcher consulted with educational experts from a local university to identify a purposeful sample of teachers known for utilizing inquiry techniques. The teachers who were recommended were personally contacted for interview appointments by the researcher. To better understand the participants’ beliefs about inquiry, the researcher asked the teachers to discuss their teaching styles and personal beliefs about instruction, their understandings about inquiry education, their experience with inquiry when they were students, perceptions about educational change, and their preferred problem-solving styles. Within this context, the teachers were asked to define inquiry learning and to discuss how they implemented it in their classrooms.
Description of the Sample

Nine elementary school teachers participated in this study. The grade levels taught ranged from grades 3 to 5. The range of teaching experience was 2 to 23 years. Eight of the teachers were female and one was male. The teachers in this study taught in schools from middle- to upper-middle class suburban towns in the northeast United States. The average family income in these districts ranged from $62,107 to $121,741. Although even the US Census Bureau does not have a definition for middle class, several sources agreed that the highest 20% of earners comprise the upper class, the lowest 20% of earners comprise the lower class, and the middle 60% of earners comprise the middle class (Mason & Sullivan, 2010; Wellner, 2000). A middle class income is defined as $25,000-$100,000, and upper middle class income is defined as above $100,000 as reported by Financial Samurai, an online site often cited in the Wall Street Journal (Financial Samurai, 2012). The student populations and all of the teachers from these schools were predominantly White. Each teacher was given a pseudonym for privacy (see Tables 3 and 4 for teacher characteristics).

For the purpose of grouping the teachers based on the observed use of inquiry in their lessons, each subject was placed on an inquiry continuum from no inquiry to open inquiry (Martin-Hansen, 2002). However, the nature of the data (observations, interviews, and the problem-solving styles instrument) did not allow for easy, accurate placement on the continuum. The researcher devised a modified version of the continuum, incorporating the language of EQUIP: Electronic Quality of Inquiry Protocol (Marshall, et al., 2008), identifying the frequency of inquiry use described by each teacher, and adding a level to properly reflect the position of each teacher in relation to the others on the continuum (see Figure 3 for alignment of the inquiry continuum constructs). This modification is discussed
in detail later. Ultimately, the teachers who used open or guided inquiry comprised the group of frequent inquiry users, and those who used structured or low inquiry comprised the group of infrequent inquiry users (see Figure 4).

Many of the teachers participating in this study were direct and straightforward when expressing their opinions. Others were more reserved, but answered the questions sincerely and thoroughly. It was awe-inspiring to witness the passion, love for teaching, and concern that the teachers expressed for their students. Their dedication to teaching and willingness to discuss the issues related to this study has contributed enormously to the understanding of catalysts and barriers to inquiry implementation.
Table 2

*Characteristics of Frequent Inquiry-use Teachers*

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Number of Years Teaching</th>
<th>Grade Taught</th>
<th>Highest Degree Held</th>
<th>Lesson Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connie</td>
<td>34</td>
<td>12</td>
<td>4</td>
<td>Ph.D. in Education</td>
<td>Science</td>
</tr>
<tr>
<td>Pam</td>
<td>30</td>
<td>9</td>
<td>4</td>
<td>Master’s in Special Education</td>
<td>Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Plus 30 Credits</td>
<td></td>
</tr>
<tr>
<td>Kelly</td>
<td>54</td>
<td>23</td>
<td>3</td>
<td>Master’s in Elementary Education</td>
<td>Writing</td>
</tr>
<tr>
<td>Kristin</td>
<td>53</td>
<td>10</td>
<td>5</td>
<td>Master’s in Elementary Education</td>
<td>Science</td>
</tr>
<tr>
<td>Lauren</td>
<td>28</td>
<td>3</td>
<td>4</td>
<td>Master’s in Elementary Education</td>
<td>Social Studies</td>
</tr>
</tbody>
</table>
Table 3

*Characteristics of Infrequent Inquiry-use Teachers*

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Age</th>
<th>Number of Years</th>
<th>Grade Taught</th>
<th>Highest Degree Held</th>
<th>Lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alex</td>
<td>26</td>
<td>2</td>
<td>4</td>
<td>Master’s in Reading</td>
<td>Reading</td>
</tr>
<tr>
<td>Cathy</td>
<td>26</td>
<td>3</td>
<td>4</td>
<td>Bachelor’s in Elementary Education</td>
<td>Reading</td>
</tr>
<tr>
<td>Linda</td>
<td>38</td>
<td>7</td>
<td>3</td>
<td>Master’s in Elementary Education</td>
<td>Reading</td>
</tr>
<tr>
<td>Simone</td>
<td>38</td>
<td>11</td>
<td>4</td>
<td>Master’s in Elementary Education</td>
<td>Mathematics</td>
</tr>
</tbody>
</table>
Observations of Lessons: Frequent Inquiry-use Teachers

Classroom observations were conducted to verify the information reported by the subjects in their interviews. Therefore, the observations were used as part of triangulation. The teachers were told that the researcher wanted to observe a lesson that they felt exemplified their teaching styles. However, because of the questions on the SITS, some of the teachers may have suspected that inquiry was the teaching method being studied. The frequent inquiry-use teachers were invited to join the study because of their knowledge and use of inquiry, and they may have been told by the person recommending them that inquiry was the topic of study. It is difficult to know whether this knowledge was used when the teachers planned their lessons. Every teacher presented an exemplary lesson, typifying the use of direct instruction or some level of inquiry. It was notable that all of the recommended teachers conducted inquiry lessons. This could be a limitation of this study.

The results of the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008) for frequent inquiry-use teachers are presented in Table 4 at the end of this section. The rubric was divided into five categories: instructional factors, discourse factors, assessment factors, curriculum factors, and an overall view of the lesson. EQUIP: Electronic Quality of Inquiry Protocol was chosen as the best instrument to match Martin-Hansen’s continuum of inquiry, which was used as an overall classification of each subject’s stage of inquiry (2002). The characteristics of each level of inquiry in EQUIP: Electronic Quality of Inquiry Protocol (pre-inquiry, developing inquiry, proficient inquiry, and exemplary inquiry) were considered by the researcher to align with the characteristics of Martin-Hansen’s inquiry continuum (no inquiry, structured inquiry, guided inquiry, and open inquiry).
Connie and Pam

A one-hour fourth grade science lesson about the Hudson River’s estuaries was observed. The class consisted of 10 male and 11 female Caucasian students. The students were studying the effect of running water on the river bed, how the river changed when salt and fresh water met, items that floated or sank, and whether items would float better in salt or fresh water. Evidence of past experiments was scattered on tables on the periphery of the room. The experiments were kept either because the students wanted to see if changes occurred over time or because students were proud of their work and wanted to display it.

Prior to the observation, the students had devised questions they wanted to answer about the estuaries. They were gathered in small groups to choose questions to investigate and answer. The teachers split the teaching, with Pam facilitating material distribution and Connie conducting the lesson. The students were so excited to begin their experiments that it was difficult for the teachers to keep their attention during directions. Some students were observed to be off-task at this time, but were able to return their attention to the experiments.

The small groups were asked to agree on a minimum of three questions to answer. Once the groups had their questions, they visited the materials table to gather supplies to answer their specific questions. The groups were observed performing the experiments and discussing the results. Connie visited each table and spent about 10 minutes with each group of students to discuss, clarify, and reflect on what was learned. She spent time helping students to make sense of their results, asked probing questions, and left each table with suggestions for further investigation or discussion.

Some of the observed inquiry attributes of the lesson included social learning in small groups, students posing their own questions, teachers as facilitators, and student choice about
what to record and how to record it. For example, some students chose to sketch their findings before writing while others preferred to write notes or reports. The students were expected to use the available materials to design a method of investigation to answer the research questions.

**Instructional factors.** The teachers scored at the proficient inquiry level on the instructional factors section of the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008). The students were engaged in activities that helped them understand the concepts associated with their estuary study. The students were required to explore on their own before they had a shared discussion with the teacher. Ample time was allowed for discourse between the students, and they had to apply their knowledge to understand new concepts. The teachers consistently and effectively served as facilitators.

**Discourse factors.** Discourse factors also scored in the proficient inquiry stage. Students posed their own questions and discussed their results together, but no evidence of students critiquing each other was observed. The students were obliged to explain and justify their answers. The tone of discourse between the teachers and the students was conversational in nature, and the teachers consistently engaged students in open-ended discussions. The teachers left each group with something new to discuss as a result of asking probing questions.

**Assessment factors.** Assessment factors indicated proficient inquiry with a tendency toward exemplary inquiry. Prior knowledge was assessed and instruction was modified based on this knowledge. Process-focused activities involving critical thinking that connected learning to the big picture were observed, and the students were explicitly encouraged to reflect on what they observed in their experiments. Student curiosity and
questioning were encouraged, and in some cases students thought of new questions about the topic. They were allowed to design and carry out their own experiments to try to answer these questions.

**Curriculum factors.** Curriculum factors indicated proficient inquiry. There was a significant connection to the real world, flexibility for students to plan their own investigations using materials and procedures that were provided for them, and the opportunity for students to record their results in ways that made sense to them. This inquiry lesson provided structure and support for all of the students as they posed and answered their own questions. Although the lesson had elements of open inquiry, the materials and procedures were provided for the students to guide them. The students did not ask for specific materials or suggest how the materials would be used. Therefore, this lesson was considered to be a guided inquiry. The results of the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008) supported the researcher’s opinion that this was a true inquiry lesson. It also corroborated the views expressed by the participants during the interview. Therefore, Connie and Pam were placed at guided inquiry on the continuum.

**Kelly**

A third grade cooperative writing lesson was observed in Kelly’s class, and the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008) was used to evaluate the level of inquiry demonstrated in the lesson. The class consisted of nine male and nine female students, and all except one student were Caucasian. When the researcher entered the classroom, a test preparation lesson for the state tests was in progress. When the test preparation was over, one student left the room to receive unspecified special services. The teacher quickly segued into her lesson on writing, which she integrated with the science
content the class was studying. She reviewed a hands-on science lesson the students had performed under the direction of a visiting expert on rocks and minerals the previous day. The students maintained high interest throughout the lesson as evidenced by their time on task.

The students named the rocks they had examined, and then the teacher explained that the students would be working in four groups to answer four different questions about the experiments with the visitor. She introduced the questions she had developed for the students to answer. The topics included types of rocks, names of the rocks explored, the experiment they performed with the rocks expert, and the stream table used to demonstrate what happens in a flood and how sediment settles. The teacher explained that the students may or may not get their choice of topic. She did a quick review of what some of the rock characteristics were, asking students to explain or define each one.

The students raised their hands to be part of the group for the question they wanted to answer. Most students were able to join the group they wanted, and no students seemed upset with their assignments. The groups were instructed to decide which student would do the actual recording of notes as the group conducted a discussion of the question or topic. The teacher monitored the groups and visited tables to facilitate the discussions. The students wrote rough drafts as a group, and at a later time they would edit and revise their pieces.

The researcher heard students discussing their topics. One group of students was making statements such as, “How about we…” and “You should start with a thank you to Mr. P.” (the visiting rocks expert). Two students enthusiastically agreed with writing the thank you sentence: “Yeah, that’s a good idea!” and “Yeah, it is a good idea!” Another
student said, “This is hard!” When the teacher came to facilitate, she asked the students to explain what they knew about their topic. She checked for understanding by asking students if they understood the meaning of a word, and if they could explain the dry area of the stream table.

While the children worked in their groups, the teacher took a moment to explain to the researcher that her students were improving at editing because she used mixed-ability groups. The stronger students helped the weaker ones, but the students weak in editing often contributed good ideas to the writing. She noted that the students would eventually make Word documents on the computer from their drafts, and they would publish a class book about rocks and minerals.

**Instructional factors.** The *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2009) indicated proficient inquiry on instructional factors. Although the teacher lectured at times, students were involved in activities that developed their understanding of the concepts. The teacher also asked students to explain definitions and concepts instead of telling the answers. The teacher acted as a facilitator for much of the lesson, and the students were active learners in their groups.

**Discourse factors.** Discourse factors varied, but overall the teacher scored in the developing inquiry stage. Most of the questions were literal, and most required one correct answer. The teacher facilitated the discussion, yet the discourse focused on literal understanding of the material and did not demand higher-order thinking. However, student-teacher discourse was often conversational with some student questions guiding the discussion.
**Assessment factors.** The teacher employed informal assessment techniques, such as assessing prior knowledge and teacher observation. She scored in the developing inquiry stage on assessment factors because she did not modify instruction based on her findings, expected correct answers in lieu of critical thinking, and solicited factual answers at the understanding level. However, she did encourage students to reflect on their learning, even at the understanding level.

**Curriculum factors.** Curriculum factors were scored diffusely, from pre-inquiry to proficient inquiry. The lesson was content-focused and students had only minor input as to how to record data. Eventually all of the students in the groups would have written similar papers on slightly different topics, because the writing assignment was a prescribed activity with anticipated results. However, the teacher made a point of connecting the writing to the “big picture,” using the recent flood in town as a way to connect the stream table to real world situations. Overall, the teacher was given a developing inquiry score on curriculum factors, although there was some evidence that she was moving toward proficient inquiry.

The researcher had known the participant for many years as a colleague, but had never observed her teaching. Based on the outcome of the *Survey to Identify Teaching Styles* (*SITS*) and the teacher’s reputation of using direct instruction, the researcher expected to view a direct, explicitly taught lesson. The presence of structured inquiry attributes (Martin-Hansen, 2002) was unexpected, and the teacher’s comments in her interview were enlightening. Kelly was placed on the structured part of the continuum.

**Kristin**

The researcher observed a fifth grade science lesson about light and how it behaves under certain circumstances. There were 19 students (9 males and 10 females), and 100% of
the students were Caucasian. The lesson of the day was to investigate what happens when light curves around objects. It was a one-hour, whole class lesson, with some small group discussion.

Kristin brought some shiny tablespoons from home. She passed them out to the students, and asked them to observe the spoons and write down five things they noticed. Kristin said, “After you’ve written five things, start thinking about why you see what you do.” The students were seated in small groups, and a great deal of discussion took place between them. Kristin monitored student discussions by circulating around the room and asking questions. She did not give any answers. After a few minutes she asked for the students’ attention and solicited observations from them, which she wrote on a chart.

One student said that the light made the spoon look distorted. Kristin asked the children what that meant. She accepted a variety of answers, and then synthesized them to produce a definition. Other interactions and observations follow:

A student noticed, “The colors in the spoon look metallic.”

Another student said, “Everything looks 3-D.”

Kristin: “Hmmm, does everybody see that?”

One student said, “You can see through the plastic silver spoon when you hold it close.”

Kristin replied, “Oh, you have a plastic spoon. Look at that!” The student also observed that when she looked into the bowl of the spoon, everything looked upside-down. “Now try pulling the spoon close to you—let it reflect a pencil—it’s easier to see.” The students were very excited because close up, everything looked right-side up again.
Kristin asked, “The images bend how?” A student said something quietly. Kristin repeated, “The images bend to follow the bend of the spoon. Sophia said that!” Some students started examining the handle of the spoons, but the teacher said, “We are looking at the curve of the spoon, not the handle.” Kristin was using guided, structured inquiry. There was a lot of back and forth interaction between the teacher and the students, and some discussion between students when they were observing in small groups.

Kristin said, “A student found out that it’s backwards, too! Wave your hand in front of the spoon. It’s on the opposite side!”

Next Kristin had the students observe and write down five observations about the back of the spoon. The students were busy trying different things and talking about what they noticed, so many of them did not write their answers. One student said, “When you put a pencil close to the spoon the pencil bends.”

Kristin replied, “Yes, the image bends with the curve.”

Another student said, “When you pull the spoon away it gets smaller.”

Yet another student observed, “If you turn it slightly to the side, you can see all around.”

Kristin said, “That would be useful, wouldn’t it? Where have you seen something that does that around town?”

Several students called out at once, “Oh, yeah, those big reflector things in the roads!”

Kristin: “Yes, people put them where?”
A child said, “At the end of their driveways so they can see if cars are coming.” The students all took some time to find out how much of the room they could see in the backs of their spoons. Kristin wrote all of the student responses on chart paper.

One boy observed, “It looks like my dad’s side view mirror in the car! Things are closer than they appear!” This was a real-world connection generated by the student.

Another student said, “The image is right-side up and not opposite!”

During the lesson, Kristin had passed around a convex mirror that could be used to view oneself close-up. She also used a basketball and kicked it at an angle to show the students how the light bends to the side and does not go straight when it hits a curve. She asked the students which surface reflected a wider range, convex or concave. The students discovered that convex images reflect more, but a concave shape shows objects close-up. To further demonstrate, Kristin showed the students a reflection globe from her garden. Then Kristin explained that if light hits the middle of an object it will come straight out, but if it hits a curved surface it will bend. She told the students to look at a flashlight and notice that it had a concave mirror inside. Another real world connection was formed when one student remarked, “I think the first lighthouse was a fire and a mirror!”

Kristin said, “I’m going to tell you some new words for curved surfaces. I know you like to learn new words. I’m not going to test you on this, but it’s good to know.” Kristin ended the lesson with a discussion of convex and concave surfaces.

Kristin clearly enjoyed interacting with students this way, but kept order. She mentioned in her interview that she would love to teach with inquiry more often, but that time constraints and state test preparation made it difficult.
**Instructional factors.** The students were highly engaged in the lesson most of the time. Instructional factors on *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008) indicated exemplary use of inquiry. The teacher occasionally lectured, but the students were involved in activities that helped them develop scientific concepts. The students were asked to explore the concept before explanations occurred. The students developed a depth of understanding related to the concepts, and the teacher consistently acted as facilitator.

**Discourse factors.** Discourse between the teacher and students demonstrated proficient inquiry. There was student involvement and sometimes the students asked questions that led to further investigation. The teacher may have led the students a bit, but many answers were accepted and she was willing to explore issues raised by the students. There was a conversational tone to the discussion, and higher order questions were asked abundantly.

**Assessment factors.** In the Assessment portion of *EQUIP: Electronic Quality of Inquiry Protocol*, the teacher was very open and encouraged her students’ curiosity. She encouraged critical thinking and helped students to reflect on their learning. Kristin adjusted instruction as she went along, and the students began coming up with their own real-world connections. Kristin’s assessment score indicated mostly exemplary inquiry. Kristin’s assessment of student learning consisted of monitoring and teacher observation.

**Curriculum factors.** Curriculum factors also indicated exemplary inquiry in terms of flexibility and integrating the students’ answers with real world examples and connections. However, the students were not able to decide how to record information, and were expected to organize their answers on an index card. Overall, Kristin exhibited proficient to
exemplary inquiry during her lesson on the *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008) scale. She was placed on the guided inquiry portion of the continuum.

**Lauren**

A one-hour social studies lesson was observed in Lauren’s fourth grade classroom. There were 21 children in the class; one student was Asian and the rest were Caucasian. Gender distribution consisted of 12 males and 9 females. First there was a whole group lesson and then students broke off into pairs to work collaboratively.

The teacher explained to the class that they were going to choose questions about American colonists and Native Americans to answer. The children were sitting in a circle in the meeting area and had social studies notebooks with them. Lauren said, “Open your notebooks to your ‘I notice’ and ‘I wonder’ charts. Reread them and find one that you would like an answer for.” The students took turns sharing their ideas. Then they took sentence strips and wrote their questions. When one student wanted to write two questions, Lauren said, “Sure!” As students brought their individual questions to the teacher, she took a moment to discuss them with the students. She taped them in a ladder-like arrangement on the blackboard, grouping similar questions together as she went. The students did not have input as to how to group the questions.

The teacher read the questions. “Now we want to decide which question we want to work on. Choose two that you really want to work on. You might not get your first choice, but you will get one of your choices.”

A student replied, “And we shouldn’t feel bad.”

Lauren said, “Right!”
The students put their names on post-it notes and put them on the questions they wanted to investigate. Some negotiation occurred between the teacher and students so that two people were working on each question. One girl began to get upset because she didn’t get her first choice, but was able to move on.

Next Lauren instructed, “Now come up with a research plan. Fill out your sheet with your group names, questions, and your predictions about what the answer might be.”

The students went off to their places of choice to work with their partners. The teacher met with the partners and tried to get some of them to think more broadly about their topics. For instance, two students wanted to know how the Native Americans used the eyes of their prey, because they knew that Native Americans used every part of the animals they hunted. Lauren encouraged them to think about how other parts of the body were used as well. Another group wanted to know what the Pilgrims did with heated stones. Lauren asked them to expand their topic. A group investigating what sports were played was encouraged to think about what the Native Americans and colonists did for fun in general.

Some groups began to use books in the room to begin their research. Lauren announced, “We will be using books, the Internet, and maybe any materials you have from home to answer our questions.” The teacher shared that later in the week, the students would self-assess their work and use a RAFT (Role, Audience, Format, and Topic) activity to present their research. The students’ noticings (observations) in their notebooks were used as formative assessments to help the teacher plan for the next lessons.

Lauren was very enthusiastic and energetic. She appeared to enjoy working with the students and teaching with inquiry methods. The students were fully engaged most of the time and there was an air of excitement as the room buzzed with researchers.
**Instructional factors.** On *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008), Laura’s instructional factors ranged between proficient and exemplary inquiry. There was quite a bit of explanation by the teacher, but she acted as a facilitator most of the time. The students had a certain amount of choice in their research, and they were in charge of designing their own research plans.

**Discourse factors.** Discourse factors revealed proficient inquiry, with many questions geared toward shaping student understanding, along with a few open-ended questions. There was conversation going on between the teacher and students and between the students themselves. The teacher often asked questions that required the students to defend their answers.

**Assessment factors.** Assessment factors indicated a range of proficient and exemplary inquiry. Student prior knowledge was assessed and instruction was modified accordingly. The students were encouraged to connect ideas and concepts, and formative assessment consisted of authentic measures (the RAFT project and the noticings in the students’ notebooks).

**Curriculum factors.** Curriculum factors indicated some significant connections to the world, flexibility for student research design, and the lesson flowed nicely from content into student investigation. The students only had minor input into how their information was recorded, but overall the lesson revealed proficient inquiry for curriculum factors.

The *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008) confirmed that Lauren was a teacher proficient in implementing inquiry. The observation rubric indicated some areas of exemplary inquiry as well. In her interview, Lauren revealed that she had extensive knowledge about the inquiry method, which was evidenced in her
Despite her expertise, Lauren exhibited a willingness to continue learning about this teaching method. She was very open and expressed her desire to help others. Lauren was placed on the open inquiry part of the continuum.

**Summary of Observations of Frequent Inquiry-use Teachers**

The *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2009) proved to be an extremely effective and accurate tool to measure the amount and quality of inquiry teaching in the classroom (see Table 5 for frequent inquiry-use teachers’ *EQUIP: Electronic Quality of Inquiry Protocol* results, Marshall, et al., 2008). It revealed a range of proficient to exemplary inquiry for this group of teachers. For example, Connie and Pam demonstrated a proficient level of inquiry in each of the four categories (instruction, discourse, assessment, and curriculum). Kristin and Lauren were proficient in discourse factors, but exemplary in instruction and assessment. Again, *EQUIP: Electronic Quality of Inquiry Protocol* was chosen as the best instrument to match Martin-Hansen’s continuum of inquiry, which was used as an overall classification of each subject’s stage of inquiry (2002). The characteristics of each level of inquiry in *EQUIP: Electronic Quality of Inquiry Protocol* (pre-inquiry, developing inquiry, proficient inquiry, and exemplary inquiry) described similar characteristics to Martin-Hansen’s inquiry continuum (no inquiry, structured inquiry, guided inquiry, and open inquiry). Refer to Table 1 for alignment between *EQUIP: Electronic Quality of Inquiry Protocol* and Martin-Hansen’s inquiry continuum, 2002.
Table 4

*EQUIP Rubric Results for Frequent Inquiry-use Teachers*

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<tr>
<th>Name</th>
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<th>Discourse Factors</th>
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<td>Lauren</td>
<td>4</td>
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</tr>
</tbody>
</table>

Note: The level of inquiry is denoted by the following scores: 1 = Pre-Inquiry, 2 = Developing Inquiry, 3 = Proficient Inquiry, and 4 = Exemplary Inquiry.
Observations of Lessons: Infrequent Inquiry-use Teachers

The results of the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008) for the infrequent inquiry-use teachers are presented in Table 5 at the end of this section. The rubric was divided into five categories: Instructional factors, discourse factors, assessment factors, curriculum factors, and an overall view of the lesson. The categories were matched to the teachers’ actions during the observed lessons to gauge the level of inquiry used in the classroom at that particular time. The determination of this level added to the researcher’s knowledge about where to place each participant on the inquiry continuum (Martin-Hansen, 2002).

Alex

A one-hour observation using the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2009) was conducted during a whole group reading lesson. Alex’s fourth grade class consisted of 9 males and 10 females. All but two of the students were Caucasian. The teacher identified several students with special learning needs. The lowest readers in the class read at the mid-first grade level. Alex described his class as difficult, both behaviorally and academically.

The lesson began with a review of the book the class was studying, called Crash by Jerry Spinelli (1996). After recapping the story to date, Alex asked his students, “Which part of the story surprised you most?” As the students answered, the teacher asked the rest of the class to judge the answer on a scale of zero to two, which is the scale used on the state test. The students had to justify their opinions, showing they could recognize a good answer.

The lesson progressed with the teacher reading the story aloud as the students followed along. The students had to share books, which made reading uncomfortable for
them as evidenced by the lack of attention exhibited by some. The reading was punctuated by questions, and the teacher explained vocabulary as he went along. He did not solicit student input for vocabulary definition. Examples of question stems Alex posed were:

Why do you think__?

What do you think about__?

Do you have evidence to support your answer?

Alex accepted many different answers, as long as the students could defend them.

Many of Alex’s questions were higher order thinking queries. The students who answered provided some insightful answers. For example, Alex asked why Crash’s parents were not at his football game as they had promised. A student replied, “Maybe because they are Quakers and football is too violent for them.”

Another student chimed in, “Yeah, but maybe Crash is confused because his dad didn’t come. Why isn’t he there if he promised? Maybe Crash is angry or frustrated!”

A third student said, “Maybe that’s why he was greedy with the ball!” The questions were interesting and sometimes challenging. As time went on, it was apparent that the whole-group setting began to interfere with student attention. Alex decided to let the students take turns reading aloud. The lesson ended with the teacher instructing students to write out answers in their packets of questions in preparation for the state tests. The students were also reminded to keep the state test’s writing rubric in mind as they wrote their answers.

Some characteristics of inquiry teaching were observed. For example, the teacher often acted as a facilitator between the students as they discussed the questions. The students were expected to listen to each other and be actively involved in the discussion. The
question types invited students to think critically about the story. In fact, Alex exhibited more inquiry characteristics in his teaching than expected from the results of SITS.

**Instructional factors.** Alex’s score on instructional factors indicated developing inquiry. The teacher spent most of the time on lecture and asking questions as he continued through the lesson. He occasionally acted as a facilitator, engaging some of the students in higher order discussions about the story. Due to the type of questions asked, Alex demonstrated proficient inquiry characteristics.

**Discourse factors.** In discourse factors, the amount of teacher talk fell into the developing inquiry category, with some evidence of proficient inquiry. Many of the questions focused on developing an understanding. The discussion was controlled by the teacher with very little conversation and followed a question-answer format. However, the complexity of the questions posed challenged some students to think critically, so there was a mixture of developing and proficient inquiry scores. Taken together, the discourse factors indicated proficient inquiry.

**Assessment factors.** Assessment factors indicated developing inquiry. At the beginning of the lesson Alex assessed student prior knowledge, but did not modify instruction based on student responses. Informal assessment based on student responses guided Alex to adjust his teaching as he navigated through his lesson. He expected critical thinking from his students in addition to a basic understanding of the story.

**Curriculum factors.** The curriculum factors score was difficult to discern. The score for organizing and recording information was at the pre-inquiry level, in which students had to record their answers in a packet instead of deciding how to organize the information. The lesson provided some integration of content with activity, but the quality was poor,
placing this factor in the developing inquiry level. Proficient inquiry was observed in content depth and learner centrality because the lesson provided some connection to “the big picture” (EQUIP, Marshall, et al., 2008, p. 7) and allowed for some flexibility in terms of teacher acceptance of varying answers.

The overall view of the lesson placed it in the developing stage according to EQUIP: Electronic Quality of Inquiry Protocol (Marshall, et al., 2008), but with many indications that the teacher was moving toward inquiry. The level of questioning, teacher as facilitator, acceptance of many answers, and the requirement for students to justify their answers were all activities that suggested inquiry methods. However, the focus on test answers, the lack of student involvement and responsibility for learning, and the lack of student-to-student discussion, as well as the whole group setting and use of prepared packets, placed the overall lesson in the developing inquiry category.

The results of the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008) confirmed what was observed, and what was revealed in the interview. Alex appeared to be at the developing inquiry stage in most instances. His remarks in his interview indicated his eagerness to implement inquiry, and also his caution as he attempted to implement it correctly while still teaching the curriculum. He demonstrated that he understood the need to scaffold student learning through structured to guided inquiry. Alex also indicated his hope that at some point during the school year, he would be able to release responsibility so that his students could experience a more open form of inquiry learning. Alex was placed on the structured inquiry portion of the continuum (Martin-Hansen, 2002).
Cathy

The EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008) was used to evaluate the one-hour observation in Cathy’s fourth grade classroom. There were 21 students with 8 males and 13 females. All of the students except one were of Caucasian ethnicity. A whole-group language arts lesson was observed, followed by a small group reading lesson. Both lessons focused on state testing standards and goals.

During the observation, Cathy demonstrated excellent management skills. The students followed set routines and knew what was expected during the lesson. This was demonstrated by their ability to quickly gather together with all necessary materials at hand. Most of the time during the observation, the students were on-task and highly attentive.

A teacher-centered, explicit instructional approach was observed. A whole group lesson was conducted with the students sitting on mats and the teacher seated before them, in front of a chart stand. This was compatible with Cathy’s results on SITS given prior to selection of subjects.

The students were engaged in a test preparation activity for the state test. They were working on writing a journal entry from the perspective of a character in a book they were reading, Crash by Jerry Spinelli (1996). The teacher modeled and solicited responses from the students. As she accepted responses, she changed some of the wording, explaining why her changes were made. When the paragraph was complete, the teacher asked the students to score it on a scale of zero to two, mirroring the scoring scale on the state test. The students were required to justify their answers.

Next the students were sent off to their seats to complete part of a packet about the book. They were to write their own journal entries, answering the same question that was
answered together in the large group. Three special education students were called to the reading table to work on Degrees of Reading Power (DRP, Questar, 2008) questions, which would also be on the state test. They worked on DRP packets, answering the questions and explaining their answers. They were very involved with this activity and seemed to understand the strategies for successful completion of the task.

**Instructional factors.** On the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008), Cathy scored at the pre-inquiry level in instructional factors. The lessons were teacher-centered with some input from the students, and they focused on test preparation and how to successfully pass the state test rather than higher-order thinking and depth of understanding. Also, the teacher did not accept student answers without changing the wording.

**Discourse factors.** Discourse factors also indicated pre-inquiry, although there was some evidence that the teacher attempted to engage students in literal discussions about the story. However, there was only one correct answer for many of the questions, the majority of the communication was controlled by the teacher, and the students were not expected to pursue higher-order thinking.

**Assessment factors.** Assessment factors scored at the developing inquiry level. Assessment consisted of teacher observation and adjustments to the lessons to correct student misconceptions. Cathy spent a few minutes at the beginning of the lesson assessing prior knowledge before continuing. Then she enacted a question-answer format that involved factual knowledge. At the end of the lesson, she checked for student understanding once more before the students were sent off to write their own paragraphs.
Curriculum factors. Curriculum factors scored at the pre-inquiry level. The students were not engaged in investigations or activities, the lesson was content-focused, and the students were required to fill out packets of worksheets. Giving the correct answer was encouraged, but Cathy reworded each answer to help her students learn how to answer CMT questions effectively. No inquiry teaching was observed in this lesson, as confirmed by EQUIP: Electronic Quality of Inquiry Protocol (Marshall, et al., 2008). Therefore, Cathy was placed on the developing inquiry portion of the continuum (Martin-Hansen, 2002).

Simone

A one-hour fourth grade math lesson was observed in Simone’s class. There were 19 students in the class, 12 males and 7 females, and 17 of the students were Caucasian. The students were starting a new unit on decimals in the Everyday Math Program. State and district standards were addressed. Most of the lesson was whole group, and then students went off into three groups. One group worked at the back of the room with an adult volunteer, one stayed with the teacher who re-taught the lesson, and one group worked independently.

Simone started the lesson with a short video about decimals on the Smartboard. Just prior to showing it, she told the students to use the video to think about what the next math unit would be about. After the video, she told the class to turn and talk to the students at their tables about what they thought. Simone asked, “What is the new math topic? Did you pick up on anything about why we talk about this topic?” The students discussed the questions, and then Simone stopped them to share their thoughts with the large group. The students identified decimals as the topic and said that they needed to know about decimals for money.
Simone then discussed what would be covered in this unit and reviewed a place-value chart on the Smartboard. The students had their math notebooks on their desks and were able to look at their own copies of the place-value chart. Whole number place-value was reviewed, and then Simone connected that to decimals on the right side of the decimal point. She asked, “What pattern do we see? Turn and talk.” The students answered that the numbers got bigger as you go to the left. Simone said, “That’s right, but how much bigger do they get?”

A student replied, “10 bigger.”

Simone said, “Almost, but can you explain what you mean?”

Another student said, “Oh, 10 times bigger!”

Simone said, “Right! We multiply by 10 for each place to the left. What if we go to the right? Use your knowledge to figure it out.”

A student replied, “10 less.”

Simone answered, “Well, if we multiply by 10 to go to the left, what do we do when we move to the right?”

The student cried out, “Divide!”

Simone answered, “Right, we divide. What do we divide by?”

A student said, “10!”

Simone went on, “We are going to make the same connection between whole numbers and decimals. Look at the labels on the place-value chart. Do you see a difference?”

One student said, “I’m pretty sure the decimals are fractions.”

Another student said, “I know how to use the chart!”
Simone replied, “Great! You are using prior knowledge! But what do you see in the decimal places that are different from the whole numbers?”

A student observed, “There’s a ‘ths’ after 10, 100 and 1,000.”

Simone said, “Yes, that’s right. We already have a ones column in the whole number side, so we don’t need it for the decimal side. But we do have 10ths, 100ths, and 1,000ths. Here’s your next opportunity to turn and talk. See if you can discuss, use your knowledge and the review of place value, what do you think will happen with the decimals as we go to the right?” The teacher visited the tables to hear their discussions and ask questions. “So what’s happening to the value of my numbers?”

A student replied, “They get smaller as you go to the right, by 10!”

Simone instructed, “Let me give you an example of a candy bar. The pieces are fractions, or decimals. What else can you think of?”

One student said, “Pie, pizza!”

The teacher told the students to write a decimal showing the value of this example: “If I eat 9 out of 100 pieces, what will the decimal be?” The students wrote their answers on white boards and showed them.

Simone said, “What I liked, a lot of people inserted a 0 without us even talking about it. Who can explain why you did that?”

One student said, “Nine is more than 10 so it goes to the right.”

Another student said, “There’s 100 marbles and 9 are red. There are no 10s, so we go on to 100ths.”

A different student said, “It’s a place holder!”

A female student worried, “I didn’t get that at all.”
Simone said, “I know people are all in different places, and that’s fine. It’s just the first day. I’m going to adjust my plan a little and let you work on the worksheet and just give you review homework tonight” (Everyday Math often provides extension activities for further learning instead of review for homework). The students broke into the groups and began to work

**Instructional factors.** The teacher spent a lot of time leading the class in a kind of lecture, but she gave them many opportunities to explore ideas in their groups before any explanation was made. The results of the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008) indicated developing to proficient inquiry for instructional factors.

**Discourse factors.** Discourse factors fell into the developing inquiry stage, with the teacher being the center of the lesson and the students mainly working at the understanding level. However, the teacher did ask some open-ended questions and allowed for more than one answer.

**Assessment factors.** Assessment factors indicated that the teacher assessed prior knowledge and made some adjustments in her lesson as she taught. Some critical thinking was encouraged at the application stage. Teacher questioning and observation measured mostly factual knowledge. Assessment factors scored in the developing to proficient range for this lesson.

**Curriculum factors.** Curriculum factors were either content or activity focused, but not both. The students collected and organized information in prescriptive ways, but the lesson provided some depth of understanding of the big picture. Curriculum factors were in the pre-inquiry to developing inquiry range.
The teacher was engaging and enthusiastic, and she tried to use a variety of ways for students to learn, including listening, visual, and social interaction. There were no manipulatives utilized during the observed lesson. There was some evidence that the teacher used inquiry, but the method was very structured and guided by the teacher. Therefore, Simone was placed on the structured inquiry part of the continuum (Martin-Hansen, 2002).

**Linda**

The observation took place in a third grade classroom with 9 male and 9 female students. All of the students were Caucasian. A one-hour reading lesson was observed. The researcher perceived that Linda was very enthusiastic and engaged her students in their learning.

The lesson began with a review of a packet for daily oral language practice. The subject was how to spell plural nouns. Linda asked what all the words that did not change have in common, e.g., moose, sheep, fish. The students noticed they were all names of animals. Next, the class reviewed some subtraction problems they had completed earlier. It should be noted that the school requires 45 minutes of direct language arts instruction, DOL, and math review, so Linda was obligated to conduct these activities.

Fifteen minutes into the class the children gathered at the meeting area for the readers’ workshop mini-lesson and a discussion of literature circles. The class had been learning about literature circle jobs. Linda said, “You’re on the verge of running your own literature circles!” Then she introduced the job of Literary Luminary, someone who picks out interesting or important parts of stories for discussion. She wrote the names of all the jobs the students had learned so far on a chart.
The class returned to their desks to get the materials they were reading for readers’ workshop. The students were given a choice of what and where to read. They were asked to find three places in their reading that they would consider appropriate for sharing by the Literary Luminary and mark them with sticky notes.

Linda began to confer individually with students. For the first conference, she checked to see if the child’s book was just right for her. The student read and used the five finger rule to judge the difficulty of the book. Linda coached her to try chunking out the word (acquaintance). She scaffolded the learning by asking the child to read chunks pointed out by the teacher. The child had difficulty with several of the words, so the teacher stopped at the end of the page. She said, “What do you think about that book? Want to try a new one?” The child answered yes, and said the words were tricky.

In the second conference, the teacher asked the student what kind of book he had. When he didn’t answer, she said, “Do you have a non-fiction book? What is happening?” The child retold the story and then read aloud to Linda. Then Linda said, “I’m thinking something in my head right now; are you?”

The student replied, “Yes,” but did not elaborate.

Linda said, “The part you read about a fish hitting someone with a spatula, I think that’s funny, don’t you?”

The student replied, “Yes.”

Linda prompted, “Is that something you want to share as a Literary Luminary?” Then the teacher helped the student to write the idea on the sticky note. Linda mused, “I wonder why the author chose to do that.” The student did not reply. There was a lot of teacher talk and guidance, and questioning at the literal level. The types of questions were appropriate
for the purpose, which was to check understanding, but did not pursue critical thinking. The student did not attempt to engage in answering most of the questions, resulting in Linda’s use of prompts and questions.

The third conference involved Linda telling the student what to write on the sticky note. The student had a question, but was told to include the question on his sticky note. Time was beginning to run short, and the length of the conferences decreased.

The final conference was a quick check-in, because time was almost up. Linda asked, “What did you notice?” The student responded (unintelligible) and the teacher helped him decide what to say on the sticky note.

**Instructional factors.** On the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008), instructional factors indicated developing inquiry. There was a lot of teacher talk and a lot of lecture. Students were mostly dependent on the teacher to help them understand what they had read, and how to word their sticky notes. However, they did have choice in books and independent time to read and try to uncover Literary Luminaries before conferring with the teacher.

**Discourse factors.** In discourse factors, there was much teacher talk and lecture, especially at the beginning of the observation. This was to be expected given the nature of the first lesson. The questions targeted mostly literal, lower-level thinking for understanding. There was usually only one right answer for each question, and the teacher sometimes led her students to the answers she wanted. During the conferences, Linda elicited responses from the students and guided them to think about her teaching point. Linda scored in the pre-inquiry stage for discourse factors.
**Assessment factors.** In assessment, the teacher used questions and monitoring to keep track of student learning. She did assess prior knowledge through the review questions. The lessons were content-focused or activity focused, but not both. They were geared toward getting the right answer, and not much exploration was observed. Linda scored at the developing inquiry stage for assessment.

**Curriculum factors.** Curriculum factors placed Linda in the developing inquiry category. Linda’s students had some input in how to organize information, and the lesson provided some depth of content, but no connection was made to the picture. However, during conferences there was some flexibility for student-led exploration of the text. The *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008) confirmed the results of *SITS*. Linda had pre-planned her teaching points for her students and employed mostly direct instruction to accomplish her goals. Linda was placed on the developing inquiry part of the continuum (Martin-Hansen, 2002).

**Summary of Observations of Infrequent Inquiry-use Teachers**

None of the infrequent inquiry-use teachers scored exclusively at the pre-inquiry level (see Table 6 for infrequent inquiry-use teachers’ *EQUIP: Electronic Quality of Inquiry Protocol* results, Marshall, et al., 2008). All of these teachers demonstrated some evidence of inquiry attributes, categorizing them in the developing inquiry stage for some factors. Of the infrequent inquiry-use teachers, only Cathy, the most traditional teacher in the study, scored at the pre-inquiry level in two areas, discourse and curriculum. She scored at the developing inquiry level for instructional factors and assessment. Linda, who could not describe inquiry learning, scored at the developing inquiry level in all factors. There were glimpses of proficient inquiry in her assessment of students because she adjusted her
teaching to accommodate her students’ needs. Overall, both of these teachers were placed on
the developing inquiry part of the continuum (Martin-Hansen, 2002).

Alex and Simone both scored from the developing to proficient inquiry stages. Their
questioning techniques, ability to share discourse with their students, and willingness to
engage students in higher-order thinking moved them toward proficient inquiry in some
instances. According to their interviews, both teachers knew what inquiry was and how to
implement it, but admitted they were not using it to the extent that they could. These two
teachers were placed on the structured inquiry part of the continuum (Martin-Hansen, 2002),
because they exhibited some use of inquiry in their lessons as rated by the EQUIP rubric
(Marshall, et al., 2009).
Note. The level of inquiry is denoted by the following scores: 1 = Pre-Inquiry, 2 = Developing Inquiry, 3 = Proficient Inquiry and 4 = Exemplary Inquiry. This group of teachers often exhibited a mixture of inquiry levels within a sub-topic. In those cases, the researcher decided to report both levels to represent the teachers’ fluctuations between direct instruction and some evidence of inquiry use.

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Interviews

The results of all of the interviews were discussed first in terms of the questions posed to the teachers rather than by theme. The interviews provided a rich quantity of information. Therefore, it made sense to provide a rich description of the teachers’ responses by question first. Later in the chapter, the codes and themes that emerged are discussed in detail. It should be noted that the interview questions were written in clusters and grouped accordingly. The interview question clusters were:

- Teaching Style and Personal Beliefs,
- Teacher Knowledge and Perceptions about Inquiry,
- Educational Change,
- Teacher Experience with Inquiry,
- Problem-solving Style, and
- Identified Catalysts and Barriers to Teacher use of Inquiry.

The interviews were described using these as headings. This organization provided clarity and aided in comparing cases as the researcher searched for categories and the themes that eventually emerged.

Interviews: Frequent Inquiry-use Teachers

Connie and Pam

At their request, Connie and Pam were observed and interviewed at the same time. Connie and Pam were co-teachers in the same fourth grade classroom in a middle- to upper-middle class northeastern town. Connie, 34, was a regular education teacher with 12 years of teaching experience. She held a Ph.D. in education. Pam, 30, was a special education teacher, with 9 years of teaching experience. Pam held a master’s degree in special education plus 30 credits. These teachers had taught together for several years. Their class
consisted of half regular education and half special education students. Due to the make-up of the class, both teachers were assigned to the class full-time. Connie and Pam provided a lesson plan for the observation, and both teachers were pleasant and obliging during the interview.

**Teaching style and personal beliefs.** Connie described herself as an energetic teacher who provided her students with many hands-on learning experiences. She motivated students by designing an active learning environment. Her respect for her students was evident in her comment, “I definitely honor their feelings and ideas.”

Co-teacher Pam described herself as the “more organized, structured” teacher of the two. She also wanted the students to be excited about learning, and believed students should “do” rather than learn through direct instruction alone. She stated that even though the students had many opportunities to participate in science experiments, there was also structure to guide learning. She confessed that in the beginning of her partnership with Connie, she was somewhat leery of the inquiry process. However, collaborating with a teacher who successfully implemented inquiry helped her to embrace the pedagogical method.

Collaboration was very important to both Connie and Pam. They shared the instructional planning for their students and constantly re-evaluated past lessons to decide how and if they could be made more hands-on and interactive for their students. Collaboration was crucial to their ability to implement inquiry-based lessons, because they believed their different teaching styles complemented each other and made their lessons richer and more meaningful for the students. Connie’s enthusiasm and experience with inquiry education was tempered by Pam’s special education experience and structure. The
teachers explained that together, they were much more effective than if they worked alone. In addition to their own collaboration, they also spent time collaborating and planning with their fourth grade team.

Connie and Pam believed that having a partner, or any kind of support, would make it easier for all teachers to move toward inquiry teaching. In their own situation, they were able to help each other plan and implement lessons, reflect on their teaching and student learning, adjust lessons, and co-teach the lessons. They appreciated the opportunity to meet with their grade level team members as well, although they said that they would take the ideas from the meetings and rewrite them as inquiry lessons whenever possible. They emphasized that even having a paraprofessional or parent in the room during inquiry lessons would make implementation less formidable in terms of supervision.

Both Connie and Pam exhibited a passion for teaching and were very knowledgeable about inquiry education. Connie revealed that until recently, she had been providing professional development workshops on the use of inquiry in the classroom for her colleagues. Having written her dissertation about inquiry learning, Connie had definite recommendations to assist teachers new to inquiry education. These included practical measures to show teachers how to plan inquiry-based lessons, how to prepare materials, how to manage time, the opportunity for teachers to observe inquiry lessons, and on-going support throughout the year. Connie explained that school personnel needed to create professional learning experiences that people were excited about. Then teachers would want to try out new types of instruction. She shared her belief that in order to have someone think outside of the box, teachers needed to start off slowly, and perhaps form study groups. Teachers needed an expert in inquiry teaching to demonstrate and model what the method looked like in the
classroom and assure teachers that it was acceptable for a child to ask a question whose answer was not known. The teacher could turn the event into a teachable moment and demonstrate to students how to find answers to their questions.

**Teacher knowledge and perceptions about inquiry.** When they first began teaching, Connie and Pam shared the belief that inquiry education was an interesting idea, but they did not take the time to follow through on student questions. They often utilized direct instruction to enhance student learning. When their district conducted professional development training on inquiry, Connie and Pam became involved in the implementation of inquiry techniques. The teachers in their district were supposed to ask their students to think about how they would solve a problem on their own. All of the fourth grade students engaged in a research project on invasive plant species. The students all wrote a copy of the same letter to the state senator, who did not reply. Connie and Pam were unhappy with the outcome because the project did not have a significant connection to the children. They believed that students should be involved in meaningful inquiry with the opportunity to plan their own investigations. However, it was not until another professional development experience that the two teachers learned to create purposeful inquiry lessons.

Connie participated in a professional development experience using a Problem-Solving Test (PST) with students. As she learned about the technique, she became very excited about problem-solving as it related to inquiry learning. Connie investigated ways to make the PST engaging for the students. She realized that she could bring in experts to teach the students, make videos, do commercials, and even invite interns from a nearby field school to work with students. Connie designed an inquiry research project about the Hudson River, which she believed would have significance for the students because they lived in the
Hudson River valley. This experience was the beginning of Connie and Pam’s journey into inquiry-based education.

When asked to discuss their beliefs about inquiry learning, Connie and Pam both commented that teachers often became confused about the meaning of inquiry learning. Connie noted that many teachers thought inquiry learning was synonymous with “hands-on” learning. She often needed to clarify that “hands-on” learning was simply an experiment where the students are able to try things out. She shared with teachers that taking that step of having the students create their own questions is what makes the lessons inquiry-based. Some students have more freedom with the process, and they can come up with different ways to approach it. But she said that even her special education students often come up with the best questions. Connie explained that the students needed to know what the assignment was and how to conduct their inquiries. Both teachers recognized that there needed to be scaffolding along a continuum of inquiry to meet the needs of their diverse student population, so they provided differentiated experiences based on how independent they thought each student could be.

For example, at the time of this study, Pam and Connie were conducting inquiry lessons on the Hudson River estuaries. Initially, they presented information to help their students develop background knowledge for the unit. Then they asked the students to brainstorm some questions about how sediment, fresh water, and salt water behave. Once the class had compiled a list of questions, they were allowed to choose which questions to answer. The teachers provided materials for the experiments, and the students worked in groups to investigate their topics. As an example of their use of an inquiry continuum, Connie explained that several students posed their own questions and were allowed to answer
them with very little help. Other students needed more structure, and a teacher provided
guidance throughout their work.

At the time of the interview, Pam still expressed discomfort with inquiry learning.
She explained that working with Connie helped her to better understand how inquiry learning
helped students. Pam stated that because Connie could explain and support Pam during the
inquiry lessons, she felt a higher level of comfort. Another impediment to Pam’s comfort
level with inquiry was that just as she and Connie were beginning to learn how to implement
it, Connie went on maternity leave. While Connie was home with the baby, Pam did not
have enough knowledge about inquiry education to incorporate it into her lessons. After
Connie returned, Pam also went on maternity leave. It took time before the two teachers
could implement inquiry smoothly. With Connie’s support, Pam said she has grown as an
inquiry teacher. This collaboration provided Pam with information and a model to assist her
with the implementation of a method with which she felt uncomfortable and alone.

Educational change. When asked about her feelings concerning educational change,
Pam replied, “It is very overwhelming to be forced to change quickly. The most important
part about changing anything is to be provided with meaningful professional development.”
Connie explained, “When things are thrown on teachers’ plates, such as the new Common
Core State Standards, it makes the stress level rise.” She illustrated her point by stating that
there was not enough time to teach all of the required mathematics lessons prior to the state
testing. Connie and Pam acknowledged that change in education was inevitable, but they felt
overwhelmed by the number of state-mandated changes, and thought that the changes were
being implemented too rapidly for them to adjust their teaching comfortably.
**Teachers’ experience with inquiry as students.** At the end of the interview, the students were returning to class and needed Connie and Pam’s attention. The topic of teacher experience with inquiry was discussed briefly through an email. Connie remembered learning science through inquiry in college, although she did not elaborate, and Pam did not recall any inquiry experiences as a student.

**Problem-solving style.** Both Pam and Connie expressed the benefits of working together to solve problems. They also stressed the need for grade level teams to reach consensus when solving problems. The use of collaboration allowed them to accomplish their tasks and brainstorm new ideas.

**Catalysts and barriers to inquiry implementation.** When Connie and Pam were asked to discuss what they perceived to be the catalysts and barriers to teacher implementation of inquiry, they replied in a frank and candid manner.

**Catalysts.** One catalyst presented by the two teachers was the need to have enough time to develop a comfort level with the inquiry setting. Connie and Pam emphasized the importance of allowing teachers to begin slowly as novices to inquiry. They thought that if teachers could just make little changes and build on them, their confidence in the method would build and more teachers would be willing to try inquiry methods. Also, Connie and Pam believed that if teachers understood the inquiry continuum from structured, to guided, to open inquiry (Martin-Hansen, 2002), they might be more amenable to incorporating it into their lessons because they would be able to provide assistance to their students as necessary.

Another catalyst was being knowledgeable in science. Both Connie and Pam thought that their interest and understanding of science helped them envision and implement inquiry lessons, because that content area lent itself to inquiry methods. They did not mind if the
class became noisy, and they did not avoid inquiry teaching due to their students’ young ages. They were aware that their students could not walk in the door in September and participate in open inquiry. They explained that they guided the students through the steps of inquiry, but kept the instruction child-centered, allowing the students to ask and answer questions.

Both teachers believed that pragmatic professional training to teach educators how to implement inquiry in the classroom was vital to teacher willingness to try it. Pam and Connie stated that they believed that many teachers already understood the theory behind inquiry learning, but they could not visualize it in action. Teachers needed modeling and coaching by expert inquiry teachers or mentors to give them the knowledge and support they would need to implement inquiry.

**Barriers.** Pam and Connie identified several factors that they believed impeded teachers’ willingness to try inquiry in the classroom. In their opinion, Connie and Pam thought that fear of loss of control was a barrier teachers faced when deciding whether to employ inquiry learning. Loss of control included loss of classroom management, and also loss of control over what was being taught. Additionally, they thought that some teachers were afraid to appear unknowledgeable in front of their students. Connie stated that it was important for teachers to feel comfortable to learn and find answers to questions alongside their students. She noted that if you were the kind of teacher that needed to know all the answers, and weren’t willing to ask questions, then it would be difficult to teach using the inquiry approach.

Lack of extra support was also cited as a barrier to teacher willingness to implement inquiry education. Connie and Pam both expressed the need for more adults to help with the
implementation of inquiry-based lessons in the classroom. Pam said, “Last year we had a paraprofessional. So we had phenomenal support. We could have three small groups…but this year we don’t have a paraprofessional, so we had to learn to teach with just two adults. So I would say the lack of support would keep the teachers from doing inquiry lessons.”

Connie observed that the absence of enough practical professional development opportunities to learn about inquiry implementation was a major barrier to teacher use of inquiry. She explained that there had been a time when she felt too overwhelmed by curricular imperatives to seriously consider implementing inquiry in the classroom. Connie confided, “I think a lot of other teachers, me being one of them years back, were so stuck on boom, boom, boom, let’s get this curriculum all done.” She did not consider inquiry learning as a part of her teaching repertoire until she received professional development that clarified the concept for her.

Connie and Pam both asserted that a significant impediment to teacher willingness to use inquiry learning was mandatory state testing. They discussed their yearning to eliminate high-stakes testing, although they were certainly aware that this would not happen. Because of the emphasis on test scores, the lack of enough time to teach was also a factor. They explained that using inquiry could take up so much time that other units had to be shortened. Another issue with time constraints concerned the amount of time it took to practice for the state testing. These teachers freed up time for inquiry by holding test reviews before school to ensure that their students were prepared to perform well on the high-stakes state examinations.

Connie and Pam experienced a certain amount of pressure from both their teammates and the children’s parents about their use of inquiry learning. Teachers in their school were
expected to teach the same curriculum at roughly the same time. Because the inquiry units took more time, Connie and Pam were often behind the rest of their grade level. They said that it was very stressful when the rest of the team pressured them to catch up, but that they eventually taught all of the same material at a different pace.

Parents also expressed concerns that Connie and Pam’s class was not always studying the same units as the other fourth grade classes. Some parents, especially the parents of twins, pressured them to complete units in a timely manner. Connie remarked, “I think for each [unit], we do what we do because we know eventually we’re going to get everything done. We may not get it done exactly when everybody else does. Parents and other teachers do not always understand that.” Although they experienced peer and parent pressure, Connie and Pam did not consider this a major barrier to teacher use of inquiry learning, but noted that other teachers might.

It was important to Connie and Pam to feel a level of comfort with teaching through inquiry. Many teachers avoided inquiry use due to lack of confidence in the method. They contended that unless teachers understood inquiry tenets and were shown how to implement the technique in the classroom, they would probably avoid utilizing it in practice. They admitted that most of their own inquiry teaching occurred in science, an area in which they felt very comfortable. They discussed their inclination to learn along with the students, and not to feel awkward when they did not know the answer to a question. Therefore, the professional development Connie and Pam experienced helped them to implement inquiry in their classroom with confidence.
Kelly

Kelly, 56 years old, was a third grade teacher with 23 years of teaching experience. She had a master’s degree in elementary education, and had won Teacher of the Year in her district two years ago. Kelly was very comfortable during the interview because she had a prior relationship with the researcher as a former colleague. She was quite upfront about her opinions and beliefs, and projected an air of honesty and passion about teaching.

Teaching style and personal beliefs. Kelly described herself as having high expectations for students. She said, “I’ve actually been told that I’m tough, which is what a friend of mine told me was what parents are saying about me. But I have high expectations for students and I expect them to pull the line, and I try to be as clear as possible.” Holding herself to the same high standards as her students was important to Kelly. She described a situation in which she was teaching students to vary their language and word choices by eliminating words such as now, then, and next. Later that day she was teaching a math lesson when she caught herself saying, “Now.” Her students started yelling “Now” at her, and she told them to keep a tally of how many times she said the word. She told her students that if she was expecting them to be more creative in their word choices, then she had to be also.

Kelly discussed collaboration in terms of grade level meetings. She enjoyed being able to share ideas with others, and discussing topics pertinent to expectations of teachers and student achievement. Collaborative meetings were a forum where teachers could discuss state and district mandated changes in teaching and learning standards.

Kelly emphasized the need for professional development to support teachers in implementing changes in education. She thought that many teachers did not have a clear idea
about what inquiry was and how it should be implemented. She believed that appropriate professional learning opportunities would help teachers to visualize inquiry, and on-going, focused coaching would be valuable for sustaining inquiry implementation.

**Teacher knowledge and perceptions about inquiry.** Kelly shared her belief that students needed to do hands-on lessons to stimulate engagement. She did not believe children learned well by listening. In her opinion, hands-on learning was going by the wayside because educational change was coming from the top down. She felt Jean Piaget was being lost in the classroom. One way that Kelly attempted to engage students was to invite experts to her classroom to teach her students about science. During a unit of study on rocks, a former teacher who operated a rocks and minerals museum came to school to do experiments with the children. On the day of the interview and observation, the students were getting ready to write about the results of their experiments.

When discussing inquiry learning, Kelly stated that it began with a chart to record what the students know about a topic, what they wonder about the topic, and what they learned about the topic at the end of the unit (also known as a KWL chart), and then students would come up with questions that they wanted to answer. She explained that the teacher would not give the students the answer to the question, but would provide them with resources to research it themselves. Those resources could include books or the Internet. According to Kelly, this method of teaching would not work unless the students were directly taught how to use non-fiction text features such as chapter titles and the index. Direct instruction was necessary to teach the students how to perform inquiry-based investigations. She described inquiry lessons as opportunities for students to learn how to find information on their own and become independent learners.
Kelly discussed inquiry as a continuum. She thought that some students did not possess the skills to learn through open-inquiry in third grade. Kelly believed in structuring inquiry to teach students how to conduct inquiry investigations by breaking down the research skills into small steps to provide students with success. Later, after guidance and practice, students would be able to be more independent in their inquiry work.

The opportunity for students to observe the teacher looking for answers was another important aspect of learning to Kelly. She explained that she made certain that her students saw her struggling with questions and researching the answers. “Well, you have to realize that you don’t know everything. You need to show the students how to find answers to their questions. If you don’t show them how and give them the skills they need to find those answers, they’re never going to know how to conduct research. It is okay for a teacher to make a mistake, and to use that mistake to teach students,” Kelly expounded.

Kelly also stated that she would rather see students pose their own questions and search for answers than use inquiry strategies to find answers to a teacher-made assignment. If students came across something about which they were curious in their reading, for example, Kelly encouraged students not to ask her for the answers. She would rather see them take the initiative to answer their own questions by finding a book or looking for answers on the Internet. She said, “Then you know you’ve succeeded in teaching that skill that they need, and hopefully it will stay with them. So they reach the point as a student where they really become the learner, a lifelong learner. Because that’s the whole goal of education.”

Kelly explained that she currently employed a structured research process in her classroom. Initially, she provided the questions and the means for response, and the students
conducted research to find the answers. She described a project in which her students would be given a curricular topic and asked to do research and write a report. The main research project she conducted was on the state capital. The class used a computer program to set up an outline including an introduction, history, famous people, and a field trip to the state capital and state museum of history. Next, the students viewed a virtual trip to the capitol building and various points of interest in the state on the world-wide-web. An actual visit to the capitol building and state museum of history ensued, and the students wrote their reports afterwards. Kelly stated that writing the report was “very directed.” The class took notes together, and learned how to turn the notes into sentences that were used in the reports. She mentioned that the degree of teacher direction depended on the students. Some students could work fairly independently, but others had to be “spoon-fed.” In years past, Kelly had attempted to allow students to write the body of the report on their own, but she said that the students were not ready for that yet, so now she employed structured and guided inquiry practices.

Kelly also discussed her ideas about differentiation. She said, “You know, I was cleaning up files from when we were back in college. I had papers about differentiation. They were old mimeographed sheets, so it is not something new. Now everything has to be differentiation and you want to take children from where they are. You identify their needs. Here is where they are…What are you going to do to bring them forward?”

**Educational change.** Kelly held strong opinions about the recent educational changes in her state. She expressed frustration that there were many new expectations, but that the practical aspects, such as how to record data, were not in place. She thought that teachers should have more voice in how change would be implemented. Kelly hypothesized
that teachers would be more open to implementing change in practice if they had more input and clarity regarding what was required, and the tools to accomplish the changes expected by the state and district. She believed that the amount of change could deter some teachers from using inquiry methods because of the time commitment.

Kelly also articulated a desire to pilot new programs in the district before they were adopted to allow teachers to evaluate their value for student learning. Too many programs for writing, math and reading had been adopted without enough teacher input, she said. Despite the difficulties with new educational changes, Kelly made every attempt to comply with the mandates, using them to improve student learning.

**Teacher experience with inquiry.** Kelly’s most memorable experience with hands-on learning came during her undergraduate work in preparation for teaching. She reminisced about her favorite mathematics teacher saying, “Oh, she was phenomenal! She turned everything around. Everything was hands-on, we were making games. I still have the Napier’s bones I made with her, and I still use them to teach multiplication. I will teach it no other way. She was just the most phenomenal math teacher. And she made it so much fun!”

Kelly remarked that her own experience with hands-on activities in her college class demonstrated to her how engaging and enriching that type of learning could be. Although her hands-on experience was not open-inquiry, Kelly’s teaching style was influenced by this class. She chose to implement hands-on lessons in her own classroom, sometimes using inquiry methods to teach her students how to answer their own questions. This personal experience was reflected in Kelly’s structured writing lesson, which led students to synthesize information based on a previous hands-on lesson on rocks and minerals. Groups
of students were given a topic about which to write, but they were asked to discuss it among themselves and decide what information to include and how to present it.

**Problem-solving style.** Kelly preferred to solve problems by herself as much as possible before discussing them with others. She recalled a time when she had a problem with a difficult student. He did not turn in homework assignments, could not work independently, and seemed unmotivated. There were many factors affecting this child’s life, but he was not achieving in school. She worked with him to improve his attitude and motivation, and admitted to nagging him to complete his schoolwork. Although Kelly did not observe a great deal of progress, she shared that the child returned to her two years later to say he wished he had listened to her advice. He learned that if he had done what Kelly had asked of him, his life as a student would have been easier. She said, “Sometimes you have problems with a child and you don’t realize something positive came out of it, sometimes until a while after.”

**Catalysts and barriers to teacher use of inquiry.** Kelly described several factors that she perceived as barriers to teacher implementation of inquiry practices. She explained that the resolution of these barriers would result in catalysts for teacher use of inquiry in the classroom, and did not discuss them separately.

**Barriers.** Kelly thought that lack of knowledge regarding the inquiry method, and the fact that there is no manual for inquiry instruction might contribute to teachers’ reluctance to implement it. She described a need for teacher knowledge about content topics, as well as a need for training in the use of inquiry strategies. She believed that personal coaching by a teacher already versed in inquiry education would help teachers to understand what inquiry is and how to conduct it in the classroom. Teachers would need to become comfortable with
not knowing all of the answers and helping students to investigate their questions. They would also have to build a wealth of knowledge regarding the topics chosen by their students for inquiry investigations. Kelly thought that these concerns would have to be addressed before teachers could develop enough confidence to implement inquiry on their own.

Another barrier that Kelly discussed was teacher fear of not knowing all of the answers. She thought that some teachers might not be comfortable explaining to students that they needed to look up information before they could provide answers. Kelly stated that teachers should not be afraid of not knowing answers or giving the wrong answer in front of their students. She said, “Teachers need the ability to make a mistake or admit that they don’t know an answer, and move on and know that it is human…You are a human being. We’re not perfect. And okay, you make this mistake and now you move on from there and this is how we fix it.” Kelly thought that teachers could use those instances as opportunities to model research for their students. She said that teachers needed to possess a comfort level with the uncertainty that can be a part of inquiry learning.

Kelly cautioned that mandated, high-stakes testing took precious time away from teaching and learning. She maintained a difference between high-stakes testing and diagnostic testing, saying, “There has to be testing, I think. Pre-testing and post-testing is very valuable. The DRP (Degrees of Reading Power, Questar, 2011) test is a valuable tool. But to put all the pressure on students with one test, that becomes the baseline as to whether or not they are successful, is totally wrong. They’re too young for that.” She explained further that she disliked and disagreed with teaching testing skills to the students because it took time away from teaching content that students should be learning.
Kelly believed in teaching students through inquiry-based methods, but she thought that third grade students were too young and lacking in the skills necessary to conduct open inquiry. Teachers’ beliefs that students lacked the ability to learn how to implement inquiry at an early age could be an impediment to teachers’ willingness to implement inquiry education. Kelly noted that many students were still struggling developmentally as learners, and that they required the process to be broken down into achievable steps to ensure successful experiences. She reflected that when she scaffolded instruction using structured inquiry, the students were able to become more independent and capable of inquiry investigations.

Because the lack of student readiness was not a matter that could be controlled due to developmental issues, Kelly thought that teachers should implement inquiry instruction along a continuum, from tightly controlled to a more open approach. She strongly believed that students, if taught how to conduct inquiry investigations through explicit instruction, could become more independent over time. This approach could entice teachers to begin inquiry implementation slowly while they were learning about how the method works. Kelly taught through direct instruction and structured inquiry to ensure that her students grasped the concepts being taught. She said that she sometimes implemented guided inquiry with her students, but that third graders were not ready for open inquiry.

Kristin

Kristin was chosen to participate in this study because she was recommended as a teacher who used inquiry on a regular basis. Teaching was a second career for her, and at 53 years old, she had been teaching fifth grade for 10 years. She shared that she loved teaching,
and felt that she had made the right decision by changing her career. Kristin had a quiet, confident demeanor about her as she executed her lesson and participated in the interview.

**Teaching style and personal beliefs.** Kristin shared that she did not rely on what she had learned in her teacher preparation, but rather on her own knowledge about children when making instructional decisions. She stated that she had grown children whose ages ranged from 19 to 27, and although she had worked while her children were little, she said that she spent a great deal of time investigating all kinds of topics with them. One example she shared was an experiment on sinking and floating. Kristin’s children made predictions prior to the actual experiment, and tested their hypotheses on various objects. Looking back, Kristin said that now she realized that her work with her own children was exactly what would be done in an inquiry lab in science at school today. By observing how her own children learned, and what they enjoyed, Kristin came to the conclusion that children needed to be actively involved in their own learning. To her, inquiry learning was an effective way to engage children.

Kristin said, “So I think all of those experiments with my own children had to drive my planning and thinking much more than looking at textbooks or thinking back on classes I took about how to teach. Having said that, I understand that kids really do need to be able to use books and conduct research and find material in books, and I include that kind of learning in my units.” Kristin went on to say that she utilized direct instruction as an effective teaching method, and that her teaching was not all hands-on, but because she enjoyed teaching with inquiry, her students did, too. She stated that she believed that inquiry learning often resulted in deeper learning for her students.
Kristin saw herself as someone willing to collaborate and help other teachers in their efforts to use inquiry education. Although she was not a trained mentor, she shared that she spent time with other teachers, providing ideas and materials to help them overcome some of the barriers to inquiry implementation. Kristin believed that having the support of a colleague was crucial to the teacher’s success when learning to conduct inquiry lessons. She added that collaboration with her grade level team was also beneficial for lesson planning and increasing student achievement.

Kristin tried to assist interested teachers in developing an understanding of inquiry and how it is used in the classroom. She thought that professional development and learning were essential to teacher acceptance of inquiry. She emphasized the necessity of modeling and coaching teachers who were new to inquiry. She echoed Connie and Pam’s belief that teachers need to know how to implement inquiry more than they need to know why. Kristin thought that most teachers already understood why inquiry learning was important, but that they possessed insufficient skills to implement it.

**Teacher knowledge and perceptions about inquiry.** When asked to describe her definition of inquiry, Kristin responded, “I think it is where kids are investigating, in their own hands, objects and materials and making discoveries on their own. Their understanding and memory of the lesson would be stronger because they did it themselves and they’ve discovered it themselves, and there is some guidance that has to go along with that. It is enjoyable for the students, and it allows them to experience learning so that they have a memory and understanding of it.” Kristin emphasized that she loved to use inquiry learning because students enjoyed it. On the other hand, she acknowledged the importance of direct instruction, reading to students, showing videos, and having students read books. However,
she believed that using those methods too frequently could cause student boredom and misbehavior, taking the fun out of teaching and learning.

Kristin’s favorite subjects to teach were science and mathematics. While she implemented inquiry in these subjects in class, Kristin also believed in authentic, hands-on learning at home. She shared that she provided these types of activities for parents to help their children. For example, she gave the parents mathematical problems for students to solve in the grocery store. Kristin believed that when learning was applied in authentic situations, the students would retain a better, deeper understanding of concepts over time.

Kristin recalled an inquiry science lesson she conducted for her fifth graders. She described setting up a lab for a lesson on sounds, in which she collected materials to test for insulating properties against sound. She gathered shoe boxes, noisemakers, beans in a can, fabric, bubble wrap, tissue paper and Styrofoam. Kristin found it easy to grab what she needed from home, and she suggested that her comfort level with science knowledge led her to create lessons using everyday objects. She acknowledged that it could be difficult for a teacher who did not possess as much knowledge about science to figure out interactive ways for students to learn the content.

**Educational change.** Kristin answered honestly when asked how she felt about educational change. She said, “I can’t say that I gleefully and willingly say, oh, great! Something new! I don’t always agree with the changes that they have made, but some changes that have been made are certainly better than how things were before.” The district’s former curriculum did not match the state standards, and Kristin was gratified when it was rewritten. She believed that when the national standards are enacted, more age-
appropriate reading materials would become available because textbook writers would target
the topics studied at each grade level.

One change that caused concern for Kristin was state-mandated testing. She
acknowledged that the amount of testing over the last 10 years had greatly increased. She
expressed apprehension about the amount of time that needed to be spent on test preparation
because it shortened the time available for teaching the curriculum. The use of technology
for testing purposes was troublesome to her, as well. Kristin shared that she did not think
students would be able to navigate the intricacies of the computer in a testing situation, and
that if they did not save their work properly it might disappear.

**Teacher experience with inquiry.** When Kristin was in high school, she had a
science teacher who ran an environmental science club after school. She described going
down to a river to do some experiments, saying, “I don’t even remember some of the classes
I took in high school. But I have a strong memory of the hands-on science activities.”

Kristin thought that a combination of her own experience with inquiry learning, her
interest and knowledge in science, and her observations of how her own children learned
built upon each other to shape her teaching. She also reflected on how she enjoyed her
inquiry experience as a student. Because of these factors, Kristin tried to use inquiry
teaching when possible to engage her students. She bemoaned the lack of appropriate
reading materials available for students, and did not think she could rely entirely on books to
teach her students. She hoped that with the emergence of the new standards, publishers
would produce books at appropriate reading levels to aid in teaching content.

**Problem-solving style.** According to Kristin, collaboration with other teachers was
very important to the quality of student learning because teachers needed to learn from each
other and help each other to strengthen areas of weakness. She stated that she had improved her teaching of reading and writing by discussing it with other teachers, thus benefitting her students. Kristin noted that her fifth grade team worked well together, using the groups’ strengths to design effective lessons. Kristin appreciated the opportunity to plan for change with other teachers on her grade level team. She said, “We often sit together as a grade level and come up with a plan, and that is really helpful to me.”

**Catalysts and barriers to teacher use of inquiry.** Based on her understanding of inquiry, Kristin had a number of comments regarding the catalysts and barriers that influence whether teachers decide to implement inquiry in the classroom.

**Catalysts.** Due to her fond memories of active, hands-on science that she experienced in high school, Kristin went to college to major in science. She did not do very well in her courses, so she switched majors to communications. However, she maintained a strong interest in science and remembered what she had learned in the many science courses she completed. She credited her use of inquiry-based methods with her own children, and later with her students, to her experiences in the science coursework. Kristin thought that her knowledge of science was a factor in her interest in inquiry learning.

Having a cache of materials for inquiry units would be a valuable catalyst for teachers to employ inquiry lessons, Kristin stated. One of Kristin’s colleagues was new to teaching fifth grade, and Kristin was supporting her in her attempts at implementing inquiry by putting aside materials she had used for science herself so the other teacher had easy access to them. Kristin cautioned, “I think half the battle is, what do I need? What do I bring together? If you don’t know what to gather up, and you don’t know where to look, this could be a barrier.”
Classroom support would also qualify as a catalyst to teacher use of inquiry. Kristin said that her district used to have a science coordinator to help teachers plan and teach science lessons. She thought that the students benefitted from having another teacher come into the classroom to teach occasional science lessons. The coordinator position was cut, and Kristin said she missed having an expert with whom she could plan and brainstorm ideas. However, her experiences with inquiry imparted the confidence for her to include it as a preferred method of teaching.

**Barriers.** When asked to discuss barriers to inquiry education, Kristin said, “I think that there are teachers who avoid it because it is a little bit of an unknown, where is it going to go? I’ve seen teachers who really don’t seem to want to use it because they feel like they don’t know enough about the topic.” She added that some teachers might experience discomfort not knowing the answers to student questions, and may not want students to wait until they can find the information. Inquiry teachers must also be willing to gather a variety of materials with which to teach and demonstrate concepts. To Kristin, the lack of teacher comfort and confidence in utilizing inquiry in the classroom was an obstacle to teachers’ decisions to teach through inquiry.

Insufficient teacher knowledge about inquiry and the manner of implementation was another barrier to teacher use of inquiry. Kristin thought that many teachers did not understand the purpose and benefits to student learning. The inability to visualize inquiry in the classroom was also cited as a barrier. The lack of professional training prevented the teachers from learning more about this method and how it is implemented in the classroom.

Another issue Kristin cited was that even when teachers had a specialist, such as a science coordinator, to help them, veteran teachers often declined to take advantage of this
expertise. She observed that teachers who have been in education for a long time might feel embarrassed to ask for support. She thought that all teachers should allow themselves to be secure and confident enough in their teaching to solicit assistance from the experts provided by the school district. Kristin explained that the science coordinator was proficient in inquiry teaching, and that all teachers had the opportunity to benefit from her knowledge, whether or not they chose to do so. Kristin said that newer teachers did choose to work with the specialist, and that she perceived this phenomenon to be a result of generational differences.

Lauren

Lauren, 28, was a fourth grade teacher. She was in her third year of teaching, and it was her first year in fourth grade. Before moving to Connecticut, she had held a long-term substitute position, and later a full-time teaching position in another state. She was chosen for this study because she was known for implementing inquiry learning. Through the interview process, the researcher discovered that Lauren was also part of an inquiry group at a local university that trained teachers to teach 21st Century Skills to their students. Lauren was welcoming and open with her observations and thoughts about inquiry. She provided information on inquiry to the researcher at the interview.

Teaching style and personal beliefs. Lauren described herself as a teacher who was eager to engage her students in learning. To that end, Lauren expressed her belief that hands-on learning and inquiry lessons were very effective ways to involve children. In her earlier work, she began using inquiry-based learning by implementing problem-based learning and projects. Her present teaching style evolved from those experiences. As a beginning inquiry teacher, Lauren focused on social studies as her first topic. She stated, “I like the idea of hands-on learning and really going from what the students are curious about, taking their
perspective on the topic. It is interesting that my use of inquiry has evolved over time. Now I have opened it up to science, too, because I remember thinking at first that I didn’t know how you could do this in science.”

Giving responsibility to the students was very important to Lauren. She said that she would give them the focus for the lesson, and allow them to explore how to investigate it. They developed a plan and put it into action to conduct their research. Although she modeled what she wanted her students to do, Lauren did not require every child to create the same product. For that reason, she did not give the students an example from which to derive their expressions of learning. The students were responsible for making that decision.

Lauren mentioned that it would be very difficult for her to teach without the opportunity to collaborate with her teammates and her paraprofessional. She explained, “This year I'm lucky that I have an aide for one of my students, and I always wanted to ask for a secretary, and she is the closest thing I've ever gotten (laughter). I think every teacher should have that other person in the room that really knows the students. I have other people who come into my room from time to time and they don't really know the students or just the dynamics of everything as well as we do. We work together every day and she's there for me.” This experience is in contrast to Lauren’s previous teaching position, in which she stated that the lack of a partner with whom to collaborate made Lauren feel alone, unsupported, and lonely. In her present position, Lauren appreciated having others who enjoyed collaboration.

Lauren took a few minutes to describe her involvement with a group of teachers training at a local university to coach teachers interested in implementing more effective science lessons and inquiry. She was a participant in this 3-year program with 25 other
teachers. She described the program as a coaching academy for Science, Technology, Engineering, and Mathematics (STEM) subjects. She had been able to collaborate with teachers from several surrounding towns, and she said that her teaching had changed as a result of this intensive training. Lauren hoped to become a science coach to assist other teachers in science instruction and inquiry.

Lauren stated that professional development about how inquiry learning works, the benefits of inquiry education, the inquiry continuum model, and on-going support to teachers were vital to enticing teachers to try it. Lauren explained, “I think the idea of the science coach, like the position that I am trying to do, could be a really powerful tool because I would have a way to scaffold somebody into beginning inquiry instruction. For instance, teachers could be doing a unit alongside me, or sometimes I might bring out the standards document and say, okay, well here are some things that I think that you should hit. Also, sometimes teachers are really overwhelmed by the materials management of it, which can be really chaotic, especially in science. That’s really overwhelming. But I think that somebody like a science coach could help that teacher. So that makes it a little bit easier for the teacher so that they only have to worry about some parts of it. I think that would help a teacher to want to do it more, if you kind of bring them in that way.”

**Teacher knowledge and perceptions about inquiry.** Lauren identified herself as an inquiry teacher. She was the only teacher to use those words, although Alex and Simone (both infrequent inquiry-users) said they thought they used inquiry about half the time. Lauren went on to share that she did not worry about making mistakes in front of her students. Her students asked a lot of questions, and if she did not know the answer she would ask the students to help her to find the answer. She believed that inquiry necessitated on-
going discussion between students and teacher about the various topics of study. Lauren thought it was important for her to take the time for discussion and to find resources to share with the students.

As an inquiry teacher, Lauren saw herself as the facilitator in a roomful of learners. She believed in using the continuum of inquiry to meet all of her students’ needs. She employed guided inquiry to teach the students how to pose questions and look for resources to answer them. She said that she spent a lot of time thinking about how she should plan for the next step of a session, even as she taught the present lesson. She did not think that students could simply enter the classroom and start inquiry learning. Lauren stated, “There are different levels of inquiry you can do. I just think that a lot of times you can do inquiry instead of more direct instruction and come out with the same or more powerful results. But direct instruction can be put in throughout, especially in the beginning of the year.” She explained that direct instruction was important and efficient for teaching the students how to perform the tasks involved in research. Once her students understood the protocol, Lauren was more comfortable releasing responsibility to them (Pearson & Gallagher, 1983).

Lauren’s description of the research process she used in the classroom demonstrated a great deal of thought and knowledge. Her elaboration on the steps in the process illustrated the depth of her understanding. She related that she used a three-step process, beginning with what she termed an inquiry starter to interest her students, then asking them to record what they noticed and wondered about the topic, and finally expecting them to participate in a focused investigation to answer the questions they had posed.

When Lauren was asked to discuss other methods of teaching, she stressed the importance of direct instruction. She noted that not every subject lends itself to inquiry, and
that she used direct instruction many times throughout the day. Lauren also believed that the new national standards were important to student learning and achievement, and she asserted that every teacher must know and teach them. She discussed her use of the standards while planning and the importance of integrating them into her units and daily lessons. Inquiry instruction was valuable to Lauren for teaching science and social studies, and reading on occasion, but direct instruction was also necessary to ensure that all of the standards were taught.

**Educational change.** Lauren did not see change in education as a barrier to implementing inquiry learning. She used the current changes to check her teaching by using the state standards to direct her, in effect welcoming the guidance they provided for her inquiry-based lessons. To Lauren, educational change was an inevitable part of the teaching profession. She accepted it and used it to enhance her teaching.

**Teacher experience with inquiry.** Lauren had been participating in inquiry-based lessons as part of her inquiry cohort at the university. She admitted that this experience influenced her teaching to a large degree. As a high school student, Lauren recalled her science teacher asking the class to write their own experiments. The students were given the outcome and they had to find a way to create it. However, she could not remember an instance in which she had participated in true inquiry outside of her university cohort. The inquiry cohort provided the training and support that gave Lauren the confidence to embrace and teach through inquiry methods.

**Problem-solving style.** Lauren enjoyed taking time to reflect on solving problems. She preferred to work by herself, and then discuss her thoughts with colleagues. She thought
that looking at problems in a logical way was important to finding solid solutions to problems.

**Catalysts and barriers to inquiry implementation.** Lauren had strong ideas about why some teachers were willing to implement inquiry and others were not. Her passion for inquiry learning was evident as she enumerated what she believed were catalysts and barriers to inquiry use.

**Catalysts.** Appropriate professional development could encourage teacher use of inquiry. Lauren believed that if teachers could start gradually and work to understand what inquiry learning is, why it is used, and when it is appropriate, they would be more willing to attempt it. She added that teachers needed to observe a model lesson to see inquiry in action. Starting out slowly was a point that Lauren emphasized repeatedly. She said, “Teachers could teach a unit totally the way that they’ve always done it, but at the beginning of the unit they could use just the inquiry starter where they have the students complete it and take down their Notices and Wonders, and they have a discussion about what they’re thinking.” Employing a science coach to “scaffold somebody into it [inquiry]”, or allowing an experienced inquiry teacher to teach a unit alongside the novice, were also some of Lauren’s suggestions.

Lauren proposed that having access to a collection of materials to use in inquiry lessons could be a catalyst for many teachers. By working together, Lauren suggested that teachers could gather and store banks of materials that could be shared. In fact, she mentioned that as a future coach, she would be willing to help teachers by guiding their choices of materials and collecting them for future use. She said that gathering materials was
a daunting task when teachers first decided to adopt inquiry methods, and that providing such a resource would remove that obstacle.

Knowing the benefits of inquiry learning could be regarded as a catalyst, stated Lauren. She noted that inquiry education was highly engaging for students, allowed students to make choices and become more independent learners, resulted in powerful learning, and provided a vehicle for social learning and collaboration. If teachers did not understand these benefits, they might not see the purpose of learning a new teaching method. Lauren thought that having this understanding would help teachers to gain confidence in inquiry teaching.

Lauren believed that if teachers understood that direct instruction did not have to be abandoned in favor of inquiry teaching, teachers’ fears about trying a new method might be allayed. Lauren knew that there were advantages to both methods, and that direct instruction was crucial to structuring inquiry learning. She also acknowledged using direct instruction many times throughout the day.

Lauren thought that opportunities to plan and collaborate with other teachers who were learning to implement inquiry would also enhance teacher understanding of inquiry. Teachers could brainstorm together, problem-solve, and reflect on the inquiry lessons they were performing in class. Collaboration could provide a powerful support system for teachers.

**Barriers.** The lack of teacher knowledge of content areas was also described as a barrier to teacher use of inquiry. Lauren explained that it took her some time to read about the content areas she taught so that she would have a solid background on each topic. She also had extra training in science and mathematics from her courses in the inquiry cohort.
Lauren credited this knowledge with her ease of inquiry implementation, but she listed it as a barrier to teachers new to inquiry methods.

Another barrier to teacher inquiry use was teacher lack of knowledge of the state standards. Lauren considered this knowledge vital to ensuring that students learn what they need to pass the state tests. Lauren held a strong belief that teachers must know, understand, and follow the state standards to provide an appropriate education to each student. Teachers who would avoid using inquiry in favor of direct instruction to incorporate the standards had no reason to do so. She said that if teachers knew the standards better they would realize how easily many of them could be taught in an inquiry setting.

She emphasized that many of the standards lent themselves to the inquiry method, such as English Language Arts (ELA) CC. 4. R.I.6 and CC. 4. R.I.7 (Connecticut State Department of Education, CSDE, 2013, p. 19). ELA standard 4. R.I.6 stated, “Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided” (p.19). ELA standard 4. R.I.7 stated, “Interpret information presented visually, orally, or quantitatively…and explain how the information contributes to an understanding of the text in which it appears” (p. 19). These standards would allow students to think, analyze, and report information through inquiry.

Some mathematics standards could also be taught through inquiry methods, such as standards Math Content NBT B.5 and B.6 (CSDE, 2010, p. 10). Standard NBT B.5 stated, “Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.” Standard NBT B.6 stated, “Find whole-number quotients and
remainders with up to four-digit dividends and one-digit divisors, using strategies based on
place value, the properties of operations, and/or the relationship between multiplication and
division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or
area models”. There are many ways in which to solve these problems, and students could
work with partners or small groups to discover the answers to problems and create a product
to share their work. Lauren stated that teachers could design inquiry lessons around
standards such as these.

Fear of losing control of the class could also be a barrier to teacher willingness to try
inquiry. Because they do not understand the procedures of inquiry lessons, many teachers
may believe that inquiry is an open free-for-all, stated Lauren. Learning about the controls
and procedures that must be in place could put inquiry novices’ minds to rest. Also, teacher
fear of not knowing the answers was another contributing factor to teacher reluctance to try
inquiry. Lauren acknowledged that some teachers liked to know exactly what they were
teaching, and did not like to stray from it. The nature of inquiry is uncertainty, so the
teachers who conduct inquiry lessons need to be comfortable not knowing the answers.
Making mistakes in front of students or not knowing all of the answers is a natural part of
teaching, and the teacher’s reaction may even be used as a model for students to follow when
they encounter similar circumstances.

The amount of time available for performing all the duties of a teacher was cited as an
obstacle as well. Lauren identified the need to spend more time reflecting and thinking as a
barrier to inquiry implementation. She confided that as much as she wanted to reflect on her
practice, there never seemed to be enough time. She believed that thinking and reflection
were vital to effective inquiry implementation, and to any form of teaching. Also, she
recognized that it took an extensive amount of time to plan an inquiry-based unit, and this might be daunting to teachers new to the method. Her opinion was that teachers should work together to plan, and start out slowly. Lauren also felt that too much work had to be done at home on her personal time, and she wished that there was more time in the school day for planning and preparation. Lauren also bemoaned the lack of time for collaboration and planning. She shared that she would like to have some time embedded in her weekly schedule to address those concerns.

The need for more time for students in the classroom was also a concern. Lauren felt that because inquiry lessons take longer than direct instruction, it would be helpful to increase instructional time so that students had enough time to try out their ideas. Lauren thought that teachers might consider inquiry too time consuming when there were so many curricular objectives to teach.

Pressure from her colleagues sometimes acted as a deterrent to Lauren. She said that she sometimes experienced peer pressure from teachers who did not understand the rationale for inquiry learning. It troubled her that some teachers questioned her methods and even told her that she was not teaching “the right way.”

**Interviews: Infrequent Inquiry-use Teachers**

**Alex**

Alex, 26, was a fourth grade teacher who had been teaching for two years. He held a bachelor’s degree in elementary education. His first year of teaching experience was in a second grade reading position at the district’s kindergarten through second grade school. His second year was in the same district, but as a fourth grade classroom teacher. Alex described his class as difficult due to some behavior problems, and indicated that some of his students
were still reading at a first grade level. He was concerned that the researcher would be unprepared for the contrast between some of his students. Alex was open, honest, and sincere in his responses to the interview questions.

**Teaching style and personal beliefs.** Alex described himself as “laid back” and as possessing “more of an inquiry-based style than direct teaching.” He thought of himself as a very strong leader, and credited some good teachers in his past for this ability. He was very aware of being new to the field, but explained that new teachers have much to offer because they have newer, fresh ideas from college. Alex noted that he felt confident about teaching with inquiry methods, but he was very aware of time constraints and the necessity to teach content that would be tested on the state-mandated tests. Therefore, he often chose to use direct teaching methods for the sake of efficiency.

Alex discussed cooperation and collaboration as critical skills for both students and teachers. Alex stated that his collaboration time with colleagues was invaluable, because discussing how his lessons went with other teachers helped him to clarify and adapt the lessons for all of his students. He noted that collaboration was just as important for students so they could learn from each other. Alex added that for students to participate in inquiry lessons, he needed to take the time to teach the children directly how to work in cooperative groups.

A possible catalyst Alex proposed was the opportunity for good professional development so teachers could envision what inquiry learning entailed. He suggested that most teachers needed to learn more about the practical implications of inquiry implementation. In his experience, he did not think teachers knew how to conduct inquiry lessons. He stated, “I think having professional people that are specified for inquiry, that
teach how to teach inquiry, would be really helpful for most teachers. It is the same type of thing where students don’t know how to work together unless you model it, and I don’t think teachers know how to teach inquiry unless you model it.”

Alex explained that he had a strong academic background in science and mathematics. He believed that this background knowledge and understanding made it easy for him to implement inquiry-based lessons. If teachers could build a store of knowledge, especially in science, Alex believed they would feel less intimidated by the inquiry process.

**Teacher knowledge and perceptions about inquiry.** Alex stated that he believed that inquiry methods resulted in higher level, critical thinking. He noted that he was trying to ask more critical thinking questions instead of literal questions because he maintained that students learned at a deeper level with critical thinking. Alex’s understanding of inquiry teaching relied heavily on the scientific method. He said, “We’ve gone through the scientific process, which is the inquiry method. The students come up with a question based on their observations, answer the questions, and then come up with a hypothesis. We haven’t really gotten there yet, but I have them come up with the steps of what really works the best to get their results, and they go through the whole process. I do that in every subject where it’s appropriate.”

Alex’s explanation of inquiry indicated that he was aware that inquiry could occur along a continuum. He stated that he guided the students by asking them to start out trying to solve the same problem rather than finding their own individual problems. In his estimation, the students were not ready for open inquiry because they still needed guidance and direction. Alex expressed hope that the students would eventually be able to participate in the entire process, but was anxious that the student questions would not be specific enough.
He did not discount explicit instruction in favor of inquiry, saying that he used direct instruction daily in his classroom, and that asking literal questions was crucial to gauging student understanding. Alex believed that the students needed direct guidance to learn how to engage in inquiry.

In Alex’s opinion, social learning as part of inquiry was very important. His students often worked in small groups, and he said that he wanted his students to learn from one another “even more than they will learn from me.” He also described the need to teach students how to fail so they would not feel defeated when it happened. He believed this made students resilient and allowed them to take more risks without fear of reprisal.

Educational change. Alex’s discussion about educational change revolved around the changing state standards and the state-mandated tests. He described the test scores in his district as very high, and did not think that there would be many changes in how he taught. However, because of the changes, the curriculum was being realigned to reflect the new standards, so the content would probably change. Alex accepted change in education as part of teaching, and said that he would be willing to implement any modifications for the benefit of his students.

Teacher experience with inquiry. Alex described a strong academic background in science and mathematics, and explained that he learned about the power of inquiry learning from a science professor who conducted open-inquiry investigations. This class was both frustrating and difficult because at first the class did not understand what they were supposed to do, but Alex explained that he learned how to teach with the inquiry method by experiencing it himself. Alex felt that this experience convinced him that inquiry education
was beneficial to students, and he felt confident in his ability to implement that method with his students.

Alex thought that inquiry methods were a valuable way to learn, and wanted to implement inquiry education in his own class. He consciously planned higher-order thinking questions, and expressed a desire to expand his comfort level and implementation of inquiry-based learning because of his own positive experiences with it as a student.

**Problem-solving style.** When asked to describe how he approached problems, Alex said that he preferred to think about problems by himself first without overanalyzing them. He said that he liked to come up with his own questions and think about where he would like to end up once the problem was solved. After taking the time to mull it over, Alex liked to discuss the problem with colleagues. He indicated that he had a trusting relationship with his team and that the collaborative piece of problem-solving was extremely important to him.

**Catalysts and barriers to inquiry implementation.** Alex projected enthusiasm for the benefits of inquiry instruction. He described several factors that he thought would encourage or discourage teachers from trying inquiry in the classroom.

**Catalysts.** In addition to appropriate professional development, one of the catalysts Alex identified was teacher knowledge of content, especially in science. Alex expressed his love of teaching science, saying, “I love teaching science, because it is so engaging for the students.” Hands-on learning was another attribute of inquiry learning that Alex endorsed. Alex thought that if teachers could observe how engrossed students could be during inquiry lessons, they would be willing to expand their content knowledge and try inquiry themselves.

Alex believed administrative support was a catalyst for inquiry use. He said that when he interviewed for his position, he was asked how he would implement inquiry
education, so he was aware from the beginning that the method would be expected and encouraged. Alex speculated that his strong background in mathematics and science stood out to the district as an indicator that he would be able to conduct inquiry lessons.

**Barriers.** Alex indicated that he struggled with some aspects of inquiry teaching. A recurring theme throughout the interview was Alex’s concern that he spent too much time going off-topic while teaching. It was important to him to answer student questions, but he was anxious about spending valuable learning time on questions unrelated to the curriculum or state test. Alex stated, “Sometimes the students ask way too many questions. Sometimes it works really well.” To address this issue, Alex was working with his mentor on his TEAM (Teacher Education and Mentoring) module for the state. He continued, “That’s one thing I’m working on, just to make sure that we pick what times will really work best to go off-topic and still try to relate it to the lesson.”

Alex thought that inquiry methods took up a lot of time, which could be frustrating when just telling the students the information would have been quicker, and more time would be freed up to cover other lessons. Alex stated, “Direct instruction felt like we got more done.” This response affirmed Alex’s concern about wasting time and his fear of being unable to cover the entire curriculum.

Regarding the No Child Left Behind law (US Department of Education, 2002), Alex said, “And the NCLB…You can’t really say that no child will be left behind. There are going to be children, I wouldn’t say left behind, but there are going to be children that are at different levels, and 100% of the students will never all be at goal.” Alex continued that the need to raise student achievement could hinder teachers’ willingness to implement inquiry
lessons because direct instruction was so efficient for teaching large bodies of content material.

Fear of loss of control was another barrier cited by Alex. Alex worried that veering off-topic was more likely during an inquiry-based lesson than in a direct lesson. This was a barrier to inquiry use because he feared that being off-topic would interfere with having enough time to cover lesson and curriculum content, therefore interfering with his control of instruction.

Another barrier Alex suggested was the amount of time it took to plan and collect materials for inquiry lessons. He said that teaching students to collaborate and cooperate with each other was also very time consuming. He noted, “Inquiry is a slow process, so I think as a teacher it kind of seems like you’re not getting anywhere.” In addition, he viewed the students’ ages as a possible obstacle to their readiness to participate in inquiry learning. Alex did not believe his fourth grade students were ready for open inquiry yet. Several other teachers who did not use inquiry frequently expressed the same doubts because they thought that open inquiry was unstructured.

Cathy

Cathy, 26, was in her third year of teaching fourth grade. She was gracious to open her class up for observation, and she answered the interview questions genuinely and sincerely. Cathy did not use inquiry in her lesson and said that she was unclear as to what it meant to implement inquiry. Her students experienced direct instruction in how to write answers to questions about fiction by using evidence from the text to support their thinking.

Teaching style and personal beliefs. Cathy described herself as organized, structured, compassionate, patient, and “good at getting kids into a familiar routine.” When
discussing her teaching style, Cathy said that watching other teachers has influenced her as a teacher. She shared that she primarily used direct instruction, usually in a whole class or a small group setting. She also employed individualized instruction on occasion. She expressed the desire to implement differentiation more often in her teaching, but said that she has not yet found the best way to do so. She stated, “In this district we’re all about using data to drive instruction.” She added that she used state testing results and formative and summative assessments to plan her goals and objectives.

Cathy was enthusiastic about her opportunities to collaborate with other teachers and specialists. She credited some of her success in teaching science to the help offered by the science coordinator, and Cathy felt that the time spent working in partnership with the other fourth grade teachers was invaluable. This communication was instrumental in planning units of study and lessons. In addition, it was beneficial to student learning because the teachers could brainstorm ways to improve instruction and increase student achievement.

Cathy thought that professional development should be a priority for helping teachers to implement inquiry methods in their classrooms. She thought that inquiry was very difficult to visualize in the classroom without the opportunity to observe it in action. Cathy shared that she was willing to try inquiry teaching if the proper support was offered, but without that support she did not feel confident implementing that method. Cathy explained that teachers needed to “observe schools and classrooms where inquiry is happening.” She described her conversations with a friend who was a graduate student observing in the New York City school system. The graduate school was “all about the student-centered classroom, and it is a brand new curriculum...she says it’s amazing. And it actually affects their test scores more positively than any other way [of teaching].”
**Teacher knowledge and perceptions about inquiry.** Cathy was asked to describe her definition of inquiry. She answered, “I would say leaving it up to the students to ask their own questions and formulate their own interpretations of things without being told.” Cathy explained that her students were beginning to ask the types of inferential questions that she asked them. Cathy also alluded to other characteristics that she considered part of inquiry education. For example, while discussing how limited instructional time was because of test preparation, she said that she still did hands-on activities in math. Cathy expressed her belief that student interaction with each other is the most important way for students to learn.

As an example of inquiry education at her school, Cathy discussed the science fair that takes place annually at her school. All students in grades three through six were required to participate. She described it as the application of the scientific method. Cathy noted that her school had a science coordinator who oversaw the classroom teachers who were responsible for teaching science. This coach helped the students to plan and execute their projects for the science fair.

When asked to describe the research process in her classroom, Cathy responded, “Well, in fourth grade we haven’t really done a ton of research. They do most of their research in IT [Information Technology, also known as computer laboratory time]. They learn to use the computer effectively and wisely, and use the Internet. But as far as going into books and researching information, I would say the closest we come to that is when we do non-fiction guided reading, locating information.” She discussed the necessity of guiding students through the process, citing the high readability level of most non-fiction texts and the difficulty of rewriting the text at level students could understand.
Although she lamented the lack of appropriate reading materials for research, Cathy added that over the years the science teachers had gathered many useful resources to plan hands-on, inquiry-based lessons. Cathy discussed an example of an inquiry lesson in which students were provided with a set of pictures and a set of vocabulary words. Then the students were asked to match the two sets and guess how the animals’ adaptations would help them, rather than reading about the topic or being told the information. Cathy ended by saying excitedly, “And they did! They figured it out!”

**Educational change.** As a newer teacher, Cathy explained that she perceived educational change as inevitable and part of the profession. She generally regarded change as a good thing. Cathy noted that when she joined the school district, she brought many ideas from her previous district. She felt valued when sharing her thoughts because the new district and teachers were open to trying new ways of teaching. For example, Cathy had shared her knowledge about guided reading and a writing program her prior district had used, and her new district adopted them.

Cathy reported that she had joined the language arts curriculum committee to help adapt the current curriculum to the new common core standards. She said that she was excited to have some say in the coming change and to know ahead of time what would be expected of teachers. The implementation of the common core standards was viewed as a major change, but Cathy said she was open to change because it might help improve student achievement. Although Cathy would not be involved in the actual rewriting of the curriculum, she would have input as to what must be changed.

Empowered was a word Cathy used when she described how she felt about change, because in her own district, she felt that people listened to her and that she could have an
impact on how teaching and learning changed. However, in the big picture she did not think that she had a voice. The state had all the power and Cathy felt it was necessary to embrace educational change the best way she could for the benefit of her students.

**Teacher experience with inquiry.** When questioned about her prior experience with inquiry when she was a student, Cathy could not remember a single instance of inquiry learning. In fact, when asked if she had ever been taught through inquiry methods, her reply was, “No way!” She related that she did not use inquiry education in her own classroom because she did not have a model to follow and she could not visualize it. Cathy did not believe that she had the training or support to feel confident using inquiry methods.

**Problem-solving style.** During the conversation about problem-solving style, Cathy said she preferred to think about problems first, and then discuss them with others. She said that she usually solved classroom problems on her own. For example, after some thought, she described a scene in which she had worked to solve a problem by herself. She had a student who did not like to read, so Cathy gave her books that she had loved herself as a child. The student was drawn into reading and read through the whole series of books. Cathy said she felt successful because a love of reading had bloomed within her student.

**Catalysts and barriers to inquiry implementation.** Cathy had several points to discuss when she was asked to identify her perceptions about catalysts and barriers to teacher use of inquiry.

**Catalysts.** Cathy perceived the catalysts for teacher use of inquiry to be the opposite of the barriers. One catalyst she discussed was appropriate professional development and the opportunity to observe inquiry lessons conducted by experts. She thought this would be paramount to teachers who wanted to implement inquiry, but could not envision it. She
admitted that she wanted to learn more about inquiry implementation, but she could not picture it without a model. Cathy described her classroom as being teacher-centered, even though she was aware that education was moving toward a more child-centered classroom. She acknowledged that she did not understand the inquiry process very well and that she needed to be able to observe it in action before she could imagine using it in her classroom. In Cathy’s words, “I would subscribe to it. I would just have to see it in action, observe it.”

Cathy also thought that teachers needed to learn about the benefits of inquiry on student achievement. She said that some positive effects she perceived about inquiry education were student motivation, and a “better, more lasting understanding of the information, possibly.” She noted that these positive results from inquiry instruction would most likely be perceived as catalysts by teachers who were reluctant to engage in inquiry with their students.

**Barriers.** Cathy said that one barrier to teacher use of inquiry was the perception of losing control over the class. Cathy contended that she had never felt out of control in her classroom, and that she harbored some fear about students getting off track and not learning enough if she attempted to implement inquiry lessons.

Cathy believed that lack of paraprofessional support or other adults in the classroom might discourage teacher use of inquiry methods. She did not have extra help in her classroom, and said that it would be too difficult to supervise inquiry lessons without additional help. It would be important to have enough adults available to keep the students on task.

The need for students to make goal on the high-stakes state tests was another barrier Cathy discussed. She was concerned that the students would not have time to learn all of the
content necessary to achieve on the assessments. She favored direct instruction as an
efficient way to teach her students.

Cathy stated that teacher knowledge and enjoyment of teaching content could be
barriers to teachers’ decisions to implement inquiry. She shared that she did not enjoy
teaching science, and that she did not possess a large store of background knowledge, yet she
was the assigned science teacher for her grade partnership. The senior teacher was
responsible for teaching social studies, so Cathy was accountable for teaching two science
periods several times a week. Although she did not like teaching science, she acknowledged
that she worked hard to plan the best science lessons possible to engage and teach her
students.

Linda

Linda, 38, was a third grade teacher. She had been teaching for seven years, and she
shared that she had taken some time off to have children. Her school was new to her because
she had been reassigned within her district after her return. Originally, Linda was an art
student in college. She considered becoming a child psychologist, but her counselor told her
to become a teacher first. She discovered that she loved teaching because she loved people
and children, and she continued to use her artistic skills to enhance her teaching. She
admitted, “If I could take out the politics and the paperwork, it would be the perfect job!”
Linda was enthusiastic and helpful in her answers to the researcher’s questions.

Teaching style and personal beliefs. Linda saw herself as a teacher who wanted to
empower her students to be self-reliant and responsible. She said that she encouraged them
to self-monitor and “better themselves.” She thought it was important to discover students’
weaknesses and devise ways to improve them. Character education and creating a
community of learners were significant goals for Linda. She said that her priority was to create a safe environment in which all members of the classroom community felt cared for and valued.

Linda used the word optimist to describe herself. It was extremely important to Linda that she helped her students to succeed. She revealed that she did not enjoy going to school as a child because she did not feel any connection to her teachers. Linda emphasized that it was very important to her to develop a personal relationship with each student. To that end, positive reinforcement was used often in Linda’s room. She stated, “I do a lot of positive reinforcement. I have tickets that I give out to students that are good for our classroom store, or other things, like a homework pass, lunch with me, a variety of different things.”

Linda expressed the desire for more collaboration time with tutors and other colleagues. She felt that the collaboration time that was provided was taken up with “certain things that we need to accomplish…[but] what ends up not happening is that piece of collaboration that is probably most essential, where we bring our problems to the table and brainstorm how we’re going to solve them”. Linda decried the plethora of paperwork, saying she would like to have a secretary to take care of that part of her job. She wished there was more support staff and that she could have someone in her classroom all the time to help the students with their learning tasks.

Watching and working with other teachers was very influential to Linda’s teaching style. She stated that her cooperating teacher from student teaching was the biggest influence. Other factors that helped to shape Linda’s style were professional books, talking with specialists and colleagues, workshops, and reflection on her teaching. Reflection was cited as an important activity that continued to help Linda to evaluate and adjust her teaching.
Linda stated that the workshops and professional development activities she had experienced helped to shape her teaching. She enjoyed trying new methods and ideas in her classroom. Linda cited professional development as crucial to learning about inquiry education. She said that while she was always open to new ideas, it was hard to envision inquiry in the classroom. Practical training by expert inquiry teachers, along with coaching and modeling, would be necessary for Linda to try inquiry in her classroom. She noted that she would also need training in how to fit inquiry education into the curriculum and school day.

Teacher knowledge and perceptions about inquiry. Linda believed in using direct instruction and modeling her expectations for students. She described a time when her class was doing a biography timeline. Linda read a book to the students, modeled how to make a timeline in “baby steps”, and then asked the students to attempt their own. She valued modeling to scaffold the students’ learning. She thought the use of differentiated instruction was important for her students. Linda said, “I also feel like I differentiate a lot, because if I’ve got a student who picks it up immediately, I’d rather that student go on their own and discover more…because they don’t need me to carry them through every step of the way.”

When Linda was asked to define her concept of inquiry learning, she struggled to define it. She asked if it meant discussion. With further probing, Linda said, “I think it is when students discover things on their own, and they work when they’re guided rather than taught to discover things on their own, and it can be done in a variety of different ways, whether it is in a group or they’re on their own. Or it is just they’re asking questions? That’s what I think inquiry is.” She was quite unsure and asked the researcher what inquiry was. Upon completion of her definition, the researcher explained inquiry briefly to Linda so that
there would be a basis for her insights into catalysts and barriers to teacher use of inquiry. Although Linda was not able to recite a definition for inquiry learning, once it was explained to her, Linda recognized that she did incorporate some aspects of inquiry into her teaching. She described asking open-ended questions in science, and allowing for student choice in readers’ and writers’ workshop. However, when asked if she would be comfortable conducting a full inquiry investigation, she said that she would not be confident in doing so without training and support.

When Linda took a moment to think about inquiry, she was confident that her third graders would be capable of engaging in inquiry at their level. She noted that there was a definite difference between higher and lower level groups of students based on their conversations, but that all students were able to make significant contributions to the activities.

The researcher asked Linda to describe the research process in her classroom. She explained that she did not do a lot of research in third grade. She mentioned hands-on activities such as the experiments the students were doing on properties of matter. She explained that her students began by making predictions, conducted observations, drew pictures, and participated in a closing activity.

**Educational change.** In her discussion about educational change, Linda expressed an openness to change in general. However, she thought some of the recent changes in education were unrealistic, such as the demands for accumulating reams of evidence for Scientifically Research Based Instruction (SRBI; Connecticut State Department of Education, 2012) without any guidance in how information should be reported. She was unhappy that the state government did not clarify what to report or provide forms for filing a
report. Linda stated, “Sometimes unrealistic change bothers me because I’m a rule follower, and I feel like it’s unrealistic to think that we can follow all the rules. That’s frustrating because I feel like there have definitely been certain instances where I feel like I’ve let a student down because I’ve been following rules.”

Linda thought that administrative support and the proper tools would make change easier to follow. She explained that she was frustrated at times because she felt like she did not receive enough guidance or support when implementing change. She also thought that providing clearer guidelines and samples to clarify the implementation of change would be helpful.

**Teacher experience with inquiry.** Linda could not remember experiencing any inquiry lessons as a student. She said that she vaguely remembered a class on analysis in which there was a backwards type of research. It started with the answer and she had to discover the question. She did not believe that her lack of experience with inquiry as a student influenced how she decided to teach content material, although she noted that she was not yet ready to learn about inquiry instruction due to the number of other changes occurring in her district.

**Problem-solving style.** Linda discussed her preference to talk through problems or new changes with people immediately because she thought that she was so optimistic that she sometimes failed to notice the negatives. She said she valued other people’s opinions, and thought that hearing others helped her to think more clearly. She related, “I think sometimes I can be looking at something with my rosy glasses on and I don’t always see a negative, just that’s the way I’m wired. I think it’s valuable to have lots of different opinions to stew on. And I don’t always have those opinions in my head!” Linda also stated that because she was
a rule-follower, discussing problems with others helped her to clarify what was expected of her.

**Catalysts and barriers to inquiry.** Linda expressed her confusion about what inquiry instruction was and how it should be implemented. She found it difficult to envision in the classroom. This lack of knowledge was one factor that prohibited her from attempting inquiry lessons. It was difficult for her to list catalysts and barriers separately, because she felt that the barriers would become catalysts if and when they were overcome.

**Catalysts.** One catalyst that Linda identified was appropriate professional development. To date, her district had not offered training in inquiry implementation, and she thought that if she could partake in on-going, supportive professional development she might be willing to try inquiry in her classroom. Linda stated that she was open to trying new ideas with her students, as long as she had a grasp on how to implement them. Without training, she did not feel confident implementing inquiry.

Linda explained that comprehension of the content areas in the curriculum could be a catalyst for teachers to try inquiry because they would have confidence in their knowledge base. That confidence might free teachers to try inquiry because the method would be new to them, but the content would not. She noted that she already had a store of mathematical knowledge, and that made it easier to concentrate on how to use the Smartboard in her classroom to engage her students. She thought the same principle would apply to learning to implement inquiry.

**Barriers.** According to Linda, time was an important factor in her choice not to implement inquiry education. She described professional development experiences in which she heard many wonderful ideas, but she only used one or two. Additionally, deciding to
implement a new teaching strategy seemed unrealistic to Linda at this time, because she was still learning how to teach reading through a workshop approach. Because she was already in the midst of learning a new teaching technique, she did not express any immediate interest in learning more about inquiry education.

Linda believed that another barrier to teacher use of inquiry could be high-stakes, mandatory testing. She explained that testing was a reality that interfered with her teaching. When asked how it affected her teaching, she replied, “Well, I would be lying if I said it wasn’t a lot of pressure and a lot of stress because the scores are reported in the newspaper, and I really try to incorporate as much as I possibly can into the curriculum, because I don’t want students to feel that stress.”

The fact that inquiry was not presented as a program that was ready to teach was identified as a barrier to teacher use of inquiry, as well. In Linda’s opinion, having pre-written units and questions would make inquiry implementation more appealing. That would remove the burden of coming up with new ideas all the time. Linda reflected that inquiry was another program that would take time away from what she was already doing.

**Simone**

Simone, 38, was a fourth grade teacher who held a master’s degree in special education. She had been teaching for 11 years. Simone expressed her love of learning, and that she would love to return to school for another degree one day. Her particular interests were in learning more about technology and the teaching of reading. She was welcoming, bubbly and positive during the interview.

**Teaching style and personal beliefs.** Simone described herself as “ever-developing.” She said that she was always looking for new ideas. Simone noted, “I was the
kind of person that didn’t learn something one way, I needed it four different ways, which is why I try to employ as many different strategies and visuals as possible.” Simone described herself as flexible, which she said helped her to use a variety of teaching techniques to meet her students’ needs.

Simone was asked about the most influential factor in developing her teaching style. She replied, “I think part of it is personality. But I think my style has changed over the years as I’ve learned about kids, just seeing what works and what doesn’t work, and after experimenting and playing I figure out the better way.” Simone stated that she believed that confidence and personality type were instrumental in molding a teacher’s style.

Simone mentioned several times the lack of collaborative time at her school. She thought that time for sharing and discussion with colleagues would encourage teachers to try new methods, including inquiry. Simone reported that she missed having the opportunity to share ideas and talk to her grade level teammates. Some of her colleagues were on the other side of the very large school building, and there was not enough time to travel, meet and discuss instruction. Fortunately for the teachers, the new principal in her building worked hard to find time for teachers to spend more time together. He took recess duty for the teachers, had group meetings with grade-level children, and looked for ways to build in regular meeting times for teachers. Simone compared the meetings to a cookie swap, where the teachers brought ideas and explained how they taught certain lessons. She noted that in her 11 years at the school, nothing like this had ever happened before, and this opportunity for collaboration was valued and appreciated by the teachers.

Simone said that she definitely believed that professional development on inquiry would help teachers try it. She said, “I think it has got to be a full or half day, not just two
hours before or after school. I think it has got to be in more depth. And I think it has to go beyond just the theory because I think the teachers get the theory. I think they need more of the practical ways of how to use it in a classroom.” Simone thought that focused training on how to implement inquiry in the classroom would provide the teachers with a model and a vision of how inquiry worked in the classroom.

**Teacher knowledge and perceptions about inquiry.** Simone discussed her use of differentiation in her mathematics lesson. She stated that the students who needed more support learning new concepts would be provided with manipulatives such as place value blocks or flip books. Other students were allowed to sit on the carpet with her after the lesson for re-teaching. The most capable group was allowed to work independently or in pairs. Simone said that in previous years she had taught mathematics in rigid, unchanging groups, but now she moves students in and out of groups as necessary. On Fridays, Simone spent the period reviewing, re-teaching, or extending learning through activities.

Direct teaching was an important part of Simone’s instructional repertoire. She stated that she wanted to be certain that her students possessed some background knowledge before having them find answers to questions. However, once she was sure that her students had some schema regarding a content topic, Simone said that she liked to try inquiry-based lessons to allow them to conduct investigations on their own. She felt it was important for students to be actively engaged in their learning. Simone said that she was working on increasing the amount of inquiry education she employed in her classroom. At the time of the interview, she considered herself a 50% traditional and a 50% inquiry teacher. She expressed confidence in her ability to teach using inquiry in her lessons.
Simone described the research process she employed in her classroom. She explained that she frequently used structure and guidance when teaching in the beginning of the year. The class conducted research as a group so that Simone could model the expected process. As the students gained experience in research, they were allowed more independence. Simone described the process as a slow release of responsibility from teacher to students.

**Educational change.** As for state-mandated change, Simone explained that she thought some of the changes coming from the state were far too numerous and unclear. She expressed her belief that educational change should come from teachers and other educators who spent time working with students. She did not think that teachers had enough voice in educational policy, and she was concerned that the students would have to bear the burden of unrealistic expectations.

Simone expressed a concern about the amount of freedom she could have to modify instruction for students, knowing that they all have to take the same state test. She said, “That's actually the balance, that I have trouble sometimes teaching math, especially to some of my lower kids, because I will modify to the nth degree to make sure that they're understanding the math concepts. But they don’t get those types of modifications on the state test. And that's doing them an injustice because they need more support to achieve in math.”

Regarding mandatory, high-stakes testing, Simone said that she felt pressure throughout the year to hurry through content so that students would be prepared when the time came for testing later in the year. She said that she thought it was unfortunate, but she needed to use direct instruction more often than she would like to teach material efficiently.

**Teacher experience with inquiry.** Simone did not remember learning through inquiry until she attended college. She described her experience as frustrating. Her professor
did not offer much guidance, and Simone felt as if she had been thrust into the middle of an incomprehensible project. By the end of the course, she understood that her professor was teaching the group through open-inquiry. That was where she learned how to implement inquiry.

**Problem-solving style.** Collaboration was Simone’s preferred method for solving problems. She said she preferred to talk with colleagues whenever feasible. She noted that collaboration in her school was difficult because the building was large and colleagues often taught in different wings. Teachers utilized the Internet and made phone calls to communicate and discuss problems with each other.

**Catalysts and barriers to inquiry implementation.** Simone’s thoughts on the catalysts and barriers to teacher use of inquiry were numerous. She believed that teachers in general were afraid of inquiry teaching and unsure what to do with it. She made several suggestions about the catalysts and barriers to inquiry use.

**Catalysts.** The opportunity to share ideas and collaborate could encourage teacher use of inquiry. Simone said, “I think that if teachers have the opportunity to actually sit and chat and have a share, that they’d be willing to try new ideas like inquiry, because I know that the more traditional teachers thought, oh, that is really easy if you put it that way. And I know for a fact that two of the more traditional teachers were going to try something inquiry-related with their students this morning. They’re hearing things and they’re slowly picking things up.” Simone thought that teacher confidence in inquiry methods would help them to implement it more often.

Having a collection of materials and a bank of pre-planned lessons could help teachers to try inquiry because it would not be so work-intensive. Simone explained that she
and her grade level team had worked together to produce some hands-on social studies lessons, and that it took them two years to gather enough materials to begin using the lessons. Working with others and dividing up the responsibilities made the planning much more realistic for the teachers. Simone noted that once there was a workable system, planning for inquiry-based lessons was easier.

Simone believed that if teachers understood the benefits of inquiry learning, they would be more willing to try it. She thought that inquiry increased critical thinking and resulted in deeper learning for the students. Also, she thought that student engagement and involvement increased with inquiry instruction.

Simone discussed teacher content knowledge and enjoyment as catalysts to teacher willingness to try inquiry in the classroom. Mathematics and reading were the subjects Simone enjoyed teaching the most. She explained that reading was one of her favorite activities, but teaching it gave her the most angst because reading was so important and she wanted to teach it effectively. Simone shared that when she was a student in fourth grade, she hated mathematics because it was all about doing it the teacher’s way. Because of this, she said, “I actually start off the school year asking the kids who hates math or who is scared of math? And of course most of the hands go up, and I say that was me at your age, too. And I am honest with them when I say, that’s because when I was about your age it was all about that the teacher’s way was the only way to solve math problems, and I didn’t learn that way. I sometimes needed to see things two or three different ways, but back when I was growing up that was the way you were taught.” Simone thought that teachers used their personal experiences as students to decide the best way to teach their own students.
**Barriers.** Simone believed that a low confidence level teaching a subject area was a barrier to teacher willingness to employ inquiry practices. Lack of content knowledge could be an impediment to teacher planning. Simone thought that sometimes it was difficult to “think out of the box,” and that she would try to force it to devise an inquiry lesson. Other times the ideas would just come naturally. She thought the amount of work to think up lessons that could be delivered through an inquiry approach was an obstacle to frequent use of inquiry.

Teacher self-confidence in general was another factor in teacher willingness to implement inquiry lessons. Simone recalled that when she first began teaching, she was expected to teach reading through literature circles. She remembered the more confident teachers embraced the unfamiliar method, but the less confident teachers wanted to continue teaching the way they always had. Simone stated, “I think the more traditional kinds of people are comfortable with what they are doing, and they are not very outgoing. They're a little more homebody types, I think; that is a big part of it, or your confidence in yourself.”

Simone said that another barrier to inquiry could be going off-course on a tangent. She thought that inquiry learning could be too open at times, and thus waste time. Simone stated that as a teacher, she had the responsibility to guide her students, give them a focus, and give them enough background knowledge to solve a problem. Spending too much time exploring student questions could reduce the time available for teaching necessary content.

Even though she was aware that students problem-solved when they were talking, Simone said she had difficulty letting students assume responsibility for their learning in social groups, because she wanted to ensure that she taught the content necessary for student success. She thought that many teachers would avoid implementing inquiry in their
classrooms because losing control could be disastrous, with wasted time that could not be recovered.

**Identification of Teachers for each Group**

For the purposes of this study, it was necessary to define a continuum of inquiry to describe the level of inquiry practiced by the subjects (refer to Figure 3: *Inquiry Model*). There were three constructs this researcher utilized to create a comprehensive inquiry continuum: a modified version of Martin-Hansen’s Continuum of Inquiry (2002), the four levels identified on the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et al., 2008) and the frequency of inquiry use in the observed lesson. Each construct is described in detail below. Figure 3 identifies an *Inquiry Model* the researcher created to integrate all three constructs.

The cases were grouped into teachers who frequently used inquiry, and teachers who infrequently used inquiry to allow for comparison within and between the two groups. Information from both the observations and interviews was examined to place the teachers on Martin-Hansen’s continuum of inquiry (2002). Based on the results of the observations, five teachers demonstrated clear characteristics of inquiry along a continuum (*EQUIP: Electronic Quality of Inquiry Protocol*, Marshall, et al., 2008). An important characteristic of inquiry was higher-order thinking questions, asking students to evaluate, analyze, extend, and apply knowledge. The discussions in the frequent inquiry-use teachers’ classes were open-ended, conversational, and occurred between students as well as between students and teachers. The activities were student-centered, and the teachers acted as facilitators who provided guiding questions, materials, and suggestions when students needed help. The lessons provided depth of content and the activities were well-integrated with the subject areas. The students
were expected to explain their answers, and there were some open-ended questions that did not have right or wrong answers.

In the interviews, the teachers placed in the frequent inquiry-use group demonstrated a deep understanding of inquiry teaching and its benefits for students. They acknowledged the importance of direct instruction, but they also discussed the depth of thinking and learning made possible through inquiry. These five teachers were placed on the continuum under guided or open inquiry.

The teachers placed in the infrequent inquiry-use group demonstrated some aspects of inquiry in their teaching, but their lessons were mainly teacher-centered (Marshall, et al., 2007). They lectured and asked many basic, literal comprehension questions to gauge their students’ learning. They were cognizant of the need for students to understand at a literal level. However, some of them did ask some higher-order questions, requiring students to explain their thinking and occasionally make connections. In most cases, the teachers explained concepts to the students after the students attempted explanations of their own.

In the interviews, two of the teachers in this group could not explain inquiry at all, even though their lessons demonstrated some features of inquiry teaching. Two of the teachers could explain inquiry, but said they did not use it often in the classroom. Their lessons did not illustrate true inquiry, even though the teachers could describe it. Therefore, they were placed in the infrequent inquiry-use group in the categories of no inquiry or structured inquiry (Martin-Hansen, 2002). Tables 3 and 4 illustrate the salient characteristics of each group. An account of each interview follows the observations.

**Modified Martin-Hansen continuum.** *Inquiry* was originally defined along a continuum of four levels for the purposes of this study. The Martin-Hansen inquiry
continuum (2002) identified teachers according to these four levels of inquiry practice. These were open inquiry, guided inquiry, structured inquiry, and no inquiry. Open inquiry is a student-centered approach that begins with a student’s question, followed by the student designing and conducting an investigation or experiment and communicating results. The teacher’s purpose is to serve as an expert resource. Guided inquiry involves more teacher support than open inquiry but the students share in the development and planning of investigations. The teacher may help students to pose questions, assist with research design, and provide resources to discover answers to questions. Structured inquiry, also known as directed inquiry, is directed by the teacher. The students follow teacher directions to come up with a specified end point or product, which helps them to learn the inquiry process (Martin-Hansen, 2002, p. 35, 37). No inquiry denotes the demonstrated lack of inquiry attributes demonstrated by the teacher during an observed lesson. These constructs were helpful when identifying the type of inquiry practiced, but they did not account for teacher knowledge of inquiry. The researcher decided to add a low level of inquiry to the original continuum to account for the teachers who did not have background knowledge of inquiry, but nonetheless demonstrated elements of the method in their teaching. This level applied to teachers who did not present a true inquiry lesson of any kind, but intuitively practiced some inquiry attributes, especially in their questioning methods.

**Levels of the EQUIP: Electronic Quality of Inquiry Protocol rubric.** Each lesson presented for the researcher was a snapshot of the teacher’s perception of an exceptional lesson and did not demonstrate the frequency of inquiry use over time. The EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008) was extremely useful for identifying the level of inquiry observed in a lesson. The rubric’s organization made it
possible to evaluate the levels of inquiry in several important areas: instructional factors, discourse factors, assessment factors, and curriculum factors. Each of these factors was divided into four levels: pre-inquiry, developing inquiry, proficient inquiry, and exemplary inquiry. Because of the rubric’s thoroughness, it was impossible to identify any teacher as being completely within the pre-inquiry stage. Even the teachers who did not practice inquiry per se demonstrated some aspects of inquiry on the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008). Therefore, it was necessary to create a category called low inquiry for the Martin-Hansen inquiry continuum (2002) to accurately place all of the teachers on the continuum so they could be grouped.

Alignment between Martin-Hansen and EQUIP: Electronic Quality of Inquiry Protocol continuia (refer to Table 2). The addition of a fifth level of inquiry to the Martin-Hansen continuum (2002) allowed the researcher to align the continuum with the EQUIP: Electronic Quality of Inquiry Protocol rubric (Marshall, et al., 2008). The pre-inquiry level aligned well with the no inquiry end of the continuum, the developing inquiry level aligned with low and structured inquiry, proficient inquiry aligned with guided inquiry, and exemplary inquiry aligned with open inquiry (see Table 2 for alignment characteristics). This flexibility, created by the addition of a low inquiry level, allowed the researcher to more accurately represent the teachers’ knowledge and abilities when placing them on the new Inquiry Model continuum.

Frequency of inquiry use. Kelly scored in the proficient inquiry level on EQUIP: Electronic Quality of Inquiry Protocol (Marshall, et al., 2008). She demonstrated knowledge of inquiry and explained her lesson as an inquiry lesson. Connie, Pam, Lauren and Kristin all scored in the proficiency level of the EQUIP: Electronic Quality of Inquiry Protocol, but
their lessons and discussions included many more instances of inquiry than the other teachers, bordering on the exemplary level of the rubric.

Cathy and Linda were unable to define or discuss inquiry, but they both demonstrated some instances of inquiry in their teaching based on *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008). They were beyond the pre-inquiry stage and scored at the developing inquiry level. Therefore, it could not be stated that they demonstrated no inquiry. Alex was able to define and discuss inquiry, but he did not present an inquiry lesson for the researcher. Because of his knowledge and his *EQUIP: Electronic Quality of Inquiry Protocol* scores, he was not as low in inquiry as Cathy and Linda. He scored at the developing inquiry level on the rubric. Simone was also able to define and discuss inquiry, and her lesson included a greater number of instances of inquiry than Alex. However, she scored in the developing inquiry level as well.

**Placement of teachers on Inquiry Model continuum (refer to Figure 3).** The final placement of the teachers on the continuum depended on the results of the observations, the frequency of inquiry in the lesson, and the knowledge shared by the subjects in the interviews. Because of the difference between the *EQUIP: Electronic Quality of Inquiry Protocol* scores (Marshall, et al., 2008) and the amount of knowledge demonstrated by the teachers, the researcher found it necessary to create a low level of inquiry for the continuum, and to label one of the infrequent inquiry-use teachers as a moderate inquiry user. One of the frequent inquiry-use teachers did not attain the level of the other frequent inquiry users, so she, too, was labeled a moderate inquiry-use teacher. However, the level of inquiry in her lesson was much higher than the other moderate inquiry-use teacher; therefore she was placed in the frequent inquiry-use group.
**Frequent inquiry-use group.** Kelly was placed on the continuum as a moderate inquiry-use teacher because her lesson was controlled and structured. She did demonstrate knowledge of inquiry practices in her interview, and *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008) rated her at the proficient inquiry level. Her inquiry skills were developed and clearly observable. She could not be seen as an infrequent inquiry-use teacher, so she was placed in the frequent inquiry-use group. Connie, Pam, Lauren and Kristin’s *EQUIP: Electronic Quality of Inquiry Protocol* scores placed them at the proficient inquiry level overall, but they each had some instances of exemplary inquiry in their lessons. They were knowledgeable about inquiry practices and there were many occurrences of inquiry in their lessons. Therefore, they were also placed in the frequent inquiry-use group (see Figure 3).

**Infrequent inquiry-use group.** As can be seen in Figure 3, Cathy and Linda were placed in the infrequent inquiry-use group, but they were developing because they already had some good inquiry questioning in place. Alex was placed in the infrequent inquiry-use group as well, but he demonstrated some structured inquiry in his lesson. He was developing his ability to implement inquiry. Simone demonstrated more use of inquiry in her lesson than the other members of this group. She used some aspects of structured inquiry and had knowledge of inquiry practices. She was considered a moderate inquiry-use teacher, but she was included in the low inquiry-use group because she was still at the developing inquiry level on *EQUIP: Electronic Quality of Inquiry Protocol* (Marshall, et al., 2008). None of the teachers scored all ones on *EQUIP: Electronic Quality of Inquiry Protocol*, so none of them were placed at the no inquiry level on the continuum. All of the teachers in this study presented some form of inquiry in their teaching.
### Alignment of Inquiry Continuum Constructs

<table>
<thead>
<tr>
<th>1. Modified Martin-Hansen</th>
<th>No Inquiry</th>
<th>Low Inquiry*</th>
<th>Structured Inquiry</th>
<th>Guided Inquiry</th>
<th>Open Inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Levels of the EQUIP Rubric</td>
<td>Pre-Inquiry (1)</td>
<td>Developing Inquiry (2)</td>
<td>Proficient Inquiry (3)</td>
<td>Exemplary Inquiry (4)</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 3. Inquiry Model. The levels of inquiry based on this model are Infrequent Inquiry Use (IIU), Moderate Inquiry Use (MIU), and Frequent Inquiry Use (FIU). *Denotes researcher’s addition of the low level of inquiry to the Martin-Hansen continuum (2002).*
**Table 6**

*Comparison of Martin-Hansen’s Continuum and the EQUIP Rubric*

<table>
<thead>
<tr>
<th>Martin-Hansen’s Continuum</th>
<th>EQUIP Rubric</th>
<th>Common Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Inquiry</td>
<td>Pre-Inquiry  (Level 1)</td>
<td>Teacher-centered, lecture, learning focused on facts to teach content, students were passive learners</td>
</tr>
<tr>
<td>Low Inquiry/Structured Inquiry</td>
<td>Developing Inquiry (Level 2)</td>
<td>Teacher-directed, students followed teacher directions to find specific outcomes, students explored content prior to receiving teacher explanation, small amount of student activity</td>
</tr>
<tr>
<td>Guided Inquiry</td>
<td>Proficient Inquiry (Level 3)</td>
<td>Teacher posed questions, students actively engaged in activities that helped them develop conceptual learning, students applied new learning</td>
</tr>
<tr>
<td>Open-Inquiry</td>
<td>Exemplary Inquiry (Level 4)</td>
<td>Student-centered, students posed questions and designed investigations, students consistently active learners, teacher consistently acted as facilitator, students acquired depth of understanding</td>
</tr>
</tbody>
</table>
Coding Methods

After the interviews were professionally transcribed, they were entered into HyperRESEARCH (Researchware, 2009), a computer program meant to assist in coding data. Notes from the observations were entered into HyperRESEARCH, along with the interview transcriptions, to search for commonalities and further evidence with which to develop answers to the research questions. The initial descriptive coding began while listening to and reading the transcripts of the interviews. A process called In Vivo coding (Saldaña, 2010) was incorporated into the initial coding procedure. This process “draws from the participants’ own language for codes” (Saldaña, 2009, p. 66). In later coding, the language of the participants was re-worded in a descriptive way to clarify the meaning of each code (Miles & Huberman, 1994; Saldaña, 2010). The interview data were re-coded several times until the remaining codes met all of the requirements outlined in Sharan B. Merriam’s work, *Qualitative Research: A Guide to Design and Implementation* (2009, p. 185-186):

- The categories were responsive to the research questions to insure that all the questions were answered
- The categories were exhaustive so that all relevant data chosen were included in one of the categories;
- The categories were mutually exclusive to avoid overlap of information; each piece of data was included in just one category;
- The categories were sensitive and specific to the topics examined;
- The categories were kept congruent in concept by charting the data and checking that all items in a category fit together abstractly.
The second round of coding employed Focused Coding (Saldaña, 2010). This is similar to axial coding (Merriam, 2009), in which similar codes from the original 85 codes were collapsed together. They were then grouped according to 21 final themes that were used to answer the research questions. Most of the codes that were retained and grouped under overarching themes had a frequency of 9 or 10 (see Appendix L). Several codes were not mentioned frequently, but the researcher interpreted them to be relevant to answering the research questions. Examples of these codes were fear of losing control, curriculum overload, the teacher-perceived efficiency of direct instruction, teacher knowledge of content areas, and maintaining a research process in the classroom. A summary of the themes that emerged and their related codes are presented in Table 6. The catalysts and barriers to teachers’ decisions about inquiry implementation that pertain to Question Four will be treated separately, as will problem-solving style for Question Five.

**Spheres of Influence**

Twenty-one themes emerged as salient to the research questions in this study. The researcher classified the themes from the interview analysis into two overarching categories that influenced teachers’ decisions to implement inquiry. These categories were named the internal and external spheres of influence. The internal sphere of influence included themes over which the teachers had personal control (see Table 7 for the themes and codes related to the internal sphere of influence). The second realm was the external sphere of influence, over which the teachers did not exercise personal control (see Table 8 for the themes and codes related to the external sphere of influence).

The term sphere of influence was borrowed from the Berlin Act of 1885, a political agreement between Great Britain and Germany in May of 1885 (Encyclopedia Britannica,
This term has also been used in economics (Levine, 1972; Page, 1994). Although the term does not describe political or economic affairs in this investigation, it clearly captured the origins of the themes that emerged in this research study. Therefore, the term was adopted by the researcher to distinguish between the two classifications of themes.

The purpose of distinguishing between internal and external influences was to clarify responsibility for maintaining or changing each element to enable teachers to implement inquiry more frequently and effectively. For example, teachers have personal control over choice of instructional practice, their beliefs and knowledge about teaching and learning, and their emotional reactions to educational change. Teachers do not control state-mandated change, the state standards, the amount of time for teaching and learning, their age or level of experience, their opportunities for professional development or collaboration, or their experiences with inquiry as students in school. In the interest of producing practical, actionable results, the researcher realized that a division of accountability should be provided so that the appropriate party could be expected to institute changes in practice to benefit student learning.
Table 7

 Themes and Categories under Internal Sphere (IS) of Influence

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IS Beliefs about educational change</td>
<td>Teacher empowerment, shifts in instructional practices, no voice,</td>
</tr>
<tr>
<td></td>
<td>attitude toward instructional change, too much change at</td>
</tr>
<tr>
<td></td>
<td>one time, unrealistic expectations by the districts and state</td>
</tr>
<tr>
<td>2. IS Direct instruction practices</td>
<td>Content review, time efficient, modeling, demonstration, teacher-</td>
</tr>
<tr>
<td></td>
<td>centered, teacher explaining</td>
</tr>
<tr>
<td>3. IS Student engagement</td>
<td>High or low student attention, student enjoyment, high or low</td>
</tr>
<tr>
<td></td>
<td>student involvement</td>
</tr>
</tbody>
</table>
Table 7

*Themes and Codes under Internal Sphere (IS) of Influence (continued)*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. IS Teacher emotions</td>
<td>Teacher concerns, confidence in teaching, passion for teaching, lack of confidence with content, teacher enjoyment of content areas, fear of losing control, passion for science content, risk-taking</td>
</tr>
<tr>
<td>5. IS Teacher knowledge of instructional practices</td>
<td>Bloom’s Taxonomy, data-driven decision making, differentiation, inquiry-based instruction, content knowledge, scaffolding student learning, science fair, limited knowledge of inquiry instruction</td>
</tr>
<tr>
<td>Theme</td>
<td>Codes</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>6. IS Teacher knowledge of inquiry practices</td>
<td>Exploration, hands-on learning, shared discussion between teacher and students, social learning, student-centered, student choice, student explaining, teacher as facilitator, continuum of inquiry, use of a research process in the classroom</td>
</tr>
<tr>
<td>7. IS Teacher pedagogical beliefs</td>
<td>Benefits of inquiry, teaching according to beliefs about how students learn, developmentally appropriate practice</td>
</tr>
<tr>
<td>8. IS Teacher problem-solving style</td>
<td>Orientation to Change (Explorer/Developer), Manner of Processing (External/Internal), Ways of Deciding (Person/Task)</td>
</tr>
</tbody>
</table>
Table 7
Themes and Codes under Internal Sphere (IS) of Influence (continued)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. IS Teaching style</td>
<td>Classroom management, free thinkers, traditional thinkers,</td>
</tr>
<tr>
<td></td>
<td>generational factors, rule-followers, teacher flexibility,</td>
</tr>
<tr>
<td></td>
<td>teacher self-perception</td>
</tr>
<tr>
<td>10. IS Types of questions posed</td>
<td>Higher order thinking skills (HOTS), lower order thinking skills</td>
</tr>
</tbody>
</table>
Table 8

*Themes and Codes under External Sphere (ES) of Influence*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ES Age and experience</td>
<td>Age and number of years of teaching experience</td>
</tr>
<tr>
<td>2. ES Collaboration</td>
<td>Coaching, TEAM, helping other teachers learn about inquiry, teacher partnerships to support inquiry learning, peers, paraprofessionals, students</td>
</tr>
<tr>
<td>3. ES Mandated change</td>
<td>Access to appropriate materials, implementing state standards, need to incorporate state standards into lessons, program support, technology concerns, testing preparation, testing pressure, lack of time and training</td>
</tr>
</tbody>
</table>
Table 8

Themes and Codes under External Sphere (ES) of Influence (continued)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. ES Mandated testing</td>
<td>Technology problems, too much time in test preparation, testing pressure</td>
</tr>
<tr>
<td>5. ES Parent feedback</td>
<td>Parent pressure to teach content more quickly, parent reactions to inquiry practice</td>
</tr>
<tr>
<td>6. ES Peer pressure</td>
<td>Pressure to conform to traditional teaching, discomfort caused by colleagues’ comments about inquiry use</td>
</tr>
<tr>
<td>7. ES Professional development</td>
<td>Professional learning, teachers as learners, limited training or knowledge about content areas, consult/coaching, gradual learning of inquiry practices</td>
</tr>
</tbody>
</table>
Table 8

*Themes and Codes under External Sphere (ES) of Influence (continued)*

<table>
<thead>
<tr>
<th>Theme</th>
<th>Codes</th>
</tr>
</thead>
</table>
| 8. ES  
Program support                                   | Lack of appropriate materials, administrative support, need for support staff in the classroom |
| 9. ES  
State standards                                    | Importance, implementation                                          |
| 10. ES  
Teacher experience with inquiry as students       | Yes, no                                                             |
| 11. ES  
Time constraints                                    | Curriculum overload, lack of teacher preparation time to plan inquiry lessons, personal lives, no time for reflection on practice |
Characteristics of Frequent Inquiry-use Teachers

Internal Sphere of Influence

This section describes the findings of the research according to the themes that emerged from data collected through the observations and interviews. The themes are discussed in the order they are listed in Tables 7 and 8. The salient factors are explained from the viewpoint of the subjects as they were told to the researcher. Information from the frequent inquiry-use teachers is followed by a discussion of the data gathered from the infrequent inquiry-use teachers.

Beliefs about change. The frequent inquiry-use teachers demonstrated an understanding of the inevitability of change in education. Three out of four of them were extremely concerned about how NCLB (2002) and the new state standards were affecting their students. They thought that the pressure of mandatory, high-stakes testing might inhibit learning. They were willing to implement change, but they were cautious about what the outcome for students might be.

Lauren was the only teacher interviewed to emphasize the need for teachers to know and implement the state standards. She believed that the standards should be used as a road map to guide student learning through whatever method the teacher preferred. She mentioned that she always checked her lessons against the standards to be sure they were taught. Lauren shared that even her professor in her inquiry cohort asked the students to learn the standards so that when teaching with inquiry-based lessons, they could show their administrators that the standards were being addressed.
**Direct instruction practices.** All of the frequent inquiry-use teachers believed that direct instruction was vital to student learning. Connie and Pam explained that they used direct instruction daily because inquiry instruction was too time-consuming to utilize in every lesson. They believed in using a balance of inquiry and direct instruction practices. Kelly was also a proponent of direct instruction, especially when teaching students how to implement inquiry. Although the frequent inquiry-use teachers implemented direct instruction daily, they all spoke of the greater benefits of inquiry instruction and thought inquiry should be used whenever feasible.

**Student engagement.** The researcher evaluated the amount and type of student engagement during the observed lessons. Overall, the students involved in inquiry lessons demonstrated high attention to task. They posed and answered many higher order questions as they conducted their investigations. For example, one of Lauren’s students wanted to learn about how Native Americans utilized a deer’s eyes, based on his knowledge that all of an animal’s body parts were used so that nothing was wasted. Based on the researcher’s observations, the students learning through inquiry were excited and involved in their learning.

**Teacher emotions.** All of the frequent inquiry-use teachers demonstrated confidence in their teaching overall. They recognized that during an inquiry lesson, students were the center of learning, and the teacher acted as the facilitator. Hands-on activities were used to enhance learning rather than for the sake of doing activities. The students asked questions, conducted research, and found answers to their own questions. However, all of the frequent inquiry-use teachers also understood that there was an inquiry continuum. Every one of them said that they used structured and guided inquiry, especially at the beginning of the year, and
then gradually released responsibility to the students. They believed in scaffolding students to help them learn content and the process of inquiry, and also the 21st Century Skills that included cooperation and collaboration for problem-solving.

**Teacher knowledge of instructional practices.** The teachers who frequently used inquiry possessed a great deal of knowledge, both in content and the application of inquiry methods. They spent significant time planning and gathering materials, and devoted class time to inquiry lessons. Awareness of testing demands compelled them to scramble to teach content so students were prepared for the assessment, but they often shortened certain units to accommodate inquiry-based lessons. One teacher addressed this concern by planning inquiry lessons that would include the standards. A strong belief system in regard to inquiry education appeared to inspire teachers to seek ways to weave the method into their teaching despite the obstacles facing them. A strong belief in inquiry learning did not prohibit this group from utilizing direct instruction, however. They all said that they valued direct teaching as an important and necessary strategy for student learning, and that they utilized it several times each day.

All of the frequent inquiry-use teachers emphasized the need for teachers to continue life-long learning. They believed that it was crucial for teachers to learn enough about their content areas to lead their students through inquiry investigations. Lauren stated that when she began teaching fourth grade social studies, she took the time to read and learn more about colonial America so she could guide her students. She found that with more content knowledge, she became more confident in what she was teaching.

Some key factors related to teachers’ decisions to implement inquiry were revealed. Teacher beliefs that inquiry was an important tool for student learning, knowledge and
confidence about what inquiry was and how it should be implemented, teacher knowledge and enjoyment of content areas that lend themselves to inquiry learning, the use of a research process in the classroom, and teacher willingness to spend extra time planning and preparing for inquiry lessons were characteristics of teachers who decided to teach through inquiry. Additionally, teachers who employed inquiry habitually asked higher order thinking questions. The frequent inquiry-use teachers were open to new approaches and strategies, although they did not view themselves as experts on inquiry learning.

**Teacher knowledge of inquiry practices.** Frequent inquiry-use teachers demonstrated a good understanding of the inquiry process overall. They all enjoyed teaching content areas traditionally associated with inquiry education, namely science and mathematics. Lauren taught social studies and language arts through inquiry, and Kelly taught writing through cooperative writing lessons that involved some degree of inquiry. Most of them had taken courses in science and mathematics that fueled their knowledge, which made it easier to implement inquiry lessons. Many of them explained that they found it necessary to continue learning about the content areas they taught, and they did this of their own volition. Teacher understanding of what inquiry learning encompassed and how it should be implemented was essential to whether or not a teacher chose to employ inquiry learning. All of the frequent inquiry-use teachers explained that they used inquiry all year long, providing more structure in the beginning of the year and releasing responsibility to the students as they gained experience and proficiency. Every one of the frequent inquiry-use teachers offered the researcher printed information about inquiry education, such as lesson plans and articles on inquiry. All of them were very eager to share their knowledge.
**Teacher pedagogical beliefs.** The frequent inquiry-use teachers all expressed their beliefs in the benefits of inquiry learning for students. They discussed better retention of knowledge, higher order thinking, deeper understanding of topics, and higher student engagement. They had strong beliefs that students learn best through inquiry strategies. They also believed that students of any age could be taught through inquiry, especially if they were taught the process first and then moved along a continuum toward independence.

**Teacher problem-solving style.** The teachers in both groups expressed varied problem-solving preferences. The researcher speculated that teachers who used inquiry in their classrooms might have a disposition to favor the Explorer orientation to change because Explorers enjoy looking for novel solutions to problems. However, that was not the case. The teachers maintained individual preferences that did not impact their decisions to implement inquiry. The only finding in this area was that the frequent inquiry teachers tended toward the task focus on the Ways of Deciding dimension of *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007).

**Teaching style.** The teachers who frequently chose to use inquiry methods had several teaching style characteristics in common. They held similar beliefs about how students learn, and planned instruction around those convictions. When discussing their teaching styles, the teachers described themselves as eager, energetic, and believers in hands-on experiences for student learning. One teacher, Connie, said that she wanted to honor her students’ feelings and ideas, and was able to do so through inquiry investigations. Another common factor between all of the frequent inquiry-use teachers was that they did not fear making mistakes in front of their students. They contended that teacher mistakes were teachable moments in which teachers could model how to react to them, and how to look up
answers to questions they did not know. This feeling of assurance may have freed the teachers to demonstrate to their students that all people have questions and make mistakes, and allowed teachers to model how to find answers to investigable questions.

Types of questions posed. The frequent inquiry-use teachers tended to ask more open-ended questions than the infrequent inquiry-use teachers. Their questions were planned around helping students to think deeply about the topic and the inquiry process. The students also asked higher order questions and made some high level comments. However, all of the teachers’ questions were not higher order. For example, Kelly spent time asking direct, lower order questions as a review for her students before moving on to her inquiry lesson.

Characteristics of Frequent Inquiry-use Teachers

External Sphere of Influence

The external sphere of influence factors consisted of age and experience, collaboration, mandated educational change, professional development, and teacher experience with inquiry as students. These elements emerged as salient external influences on the teachers’ instructional decisions. Each theme is discussed in the order it was presented in Table 8. This section discusses the themes as they related to the group of frequent inquiry-use teachers.

Age and experience. As a group, the frequent inquiry-use teachers were older and had more experience than the infrequent inquiry-use teachers. This finding may or may not be legitimate. The researcher did not control for age or experience, and the study was small. Perhaps a larger study or a different sample would yield different results.
Collaboration. Professional collaboration was discussed during every interview. The frequent inquiry-use teachers relied on collaboration for ideas and support. Several of them expressed the need for collaboration to make sense of educational change. Kristin, Lauren, Connie and Pam all stated that they encouraged and helped other teachers to try inquiry and to support them in their exploration of inquiry teaching. They gathered materials and shared units they had written with others, and they made themselves available to answer questions or coach. They hoped that by sharing their knowledge, other teachers would develop an understanding of the benefits of inquiry education and how it is implemented in the classroom.

Most of the frequent inquiry-use teachers expressed the need for a partner for brainstorming ideas, planning, and determining materials necessary to carry out an inquiry investigation. Many of the teachers appreciated the opportunity to collaborate with grade level team members, even if those other teachers did not practice inquiry education.

Mandated change. Many of the frequent inquiry-use teachers discussed the lack of appropriate materials available to carry out mandated changes. Although teacher use of inquiry is a thread which runs through all of the new Common Core Standards, this group of teachers understood that unless materials were readily available, it would be very difficult for teachers new to inquiry to plan and carry out lessons. Additionally, many teachers spoke of a lack of training about planning lessons around the standards. They were concerned about test preparation and pressure, and the lack of time and program support available to assist teachers in transitioning to the new teaching requirements.

Mandated testing. The teachers who implemented inquiry frequently revealed that they had some concerns about educational testing. They thought that mandatory, high stakes
testing could lead to undue pressure on students. Most of them thought that students should be evaluated in a formative rather than summative way to inform teaching. They experienced time constraints on teaching because of the necessity of test preparation, and opportunities for inquiry learning were curtailed. Another problem with mandated testing was the lack of updated technology in the schools. Kristin mentioned that several of her students had lost their work and had to retake tests, which consumed even more time. Several teachers noted that they shortened some units of study to find time to conduct more time-intensive inquiry lessons. Lauren said that she built her inquiry lessons around the new standards because she believed that was the best way to teach. She wanted to ensure that her students learned the required standards and performed well on the tests, but she also wanted to continue teaching with inquiry for their benefit.

**Parent feedback.** Two of the frequent inquiry-use teachers discussed experiencing pressure from parents about the pace with which they taught their students. Some parents thought that their children were falling behind the other students because Connie and Pam took the time to implement inquiry lessons. Connie and Pam experienced some discomfort at this concern, because they said that they always taught everything in the curriculum and their students received the same education as the rest of the grade level. This concern was not experienced by any other teachers who participated in this study.

Time constraints intensified the teachers’ perceptions that there were too many changes occurring at once. They thought that test preparation took time away from teaching and reflection on lessons. Most of these teachers thought that they were already experiencing curriculum overload because although subjects were often added to the curriculum, others were rarely taken away.
**Peer pressure.** Peer pressure was a side-effect experienced by some teachers implementing change in the form of inquiry lessons. This was not an issue for every frequent inquiry-use teacher, but for those whom it impacted, it was a very sensitive issue. Connie and Pam were under pressure from their grade level team to keep up the pace. They said it was very stressful to meet as a team because the other teachers were always asking when they would be finished with a unit, or when they would get to the next one.

Connie, Pam, and Lauren said that when other teachers discovered they were using inquiry learning, the teachers told them that they were not teaching correctly. Initially this caused the frequent inquiry-use teachers to experience doubt about their teaching. However, they continued to implement inquiry despite the pressure because they valued the benefits to student learning.

**Professional development.** As Connie mentioned in her interview, no professional development programs about inquiry education were offered in her school district. The frequent inquiry-use teachers utilized their background knowledge and experiences from learning through inquiry methods when they were students to devise and conduct inquiry lessons in their own classrooms. They collaborated with others when possible to enhance and refine their inquiry implementation skills, but there was no leadership beyond their own desire to teach with the method, despite the availability of professional development opportunities through the local Regional Educational Service Centers (RESCs). These centers were established by the state of Connecticut to provide professional development and other resources to the state’s public schools. Lauren’s participation in an inquiry cohort at a local university supported her efforts with inquiry and increased her knowledge of the
method. When discussing her inquiry cohort, Lauren said that in the future, she expected to be able to coach teachers in the use of 21st Century Skills, including inquiry techniques.

All of the frequent inquiry-use teachers expressed the need for on-going, focused, practical professional development to help teachers with inquiry implementation. They thought that teachers should be able to observe an inquiry teacher modeling lessons, and that a colleague or coach could help teachers to begin slowly and build confidence in using some aspects of inquiry before they attempted to implement entire units. Mentor teachers or coaches were mentioned by most of the frequent inquiry-use teachers, because they found collaboration and collegial support extremely helpful.

Program support. Another theme that emerged about change was the need for better program support, whether it was for inquiry lessons or data collection for SRBI purposes required by the state. The teachers did not think they had enough grade-level appropriate books and materials with which to teach. They expressed a desire for more professional development, especially in inquiry implementation. In regard to increased support for state-mandated initiatives, the teachers wanted more direction from the state concerning new initiatives because common forms for data reporting were not available, and the teachers were confused about what information the state required.

Some of the frequent inquiry-use teachers remembered having district science coaches who modeled how to teach lessons and help teachers plan. Unfortunately, these positions no longer existed and this left teachers without the necessary resources to support a new teaching technique. However, lack of training did not deter the frequent inquiry-use teachers from learning how to conduct inquiries with students, because they believed that hands-on lessons linked to inquiry learning were highly effective ways for students to learn.
The frequent inquiry-use teachers gathered their own materials and wrote their own units of study. They attempted to find ways to incorporate inquiry learning into lessons other than science. None of them believed themselves to be experts in the method, but all of them seemed eager to help other interested teachers explore how inquiry learning worked.

One topic that affected all of the teachers in both groups was the lack of support staff needed to implement inquiry efficiently. Some of the frequent inquiry-use teachers spoke fondly of the paraprofessionals who helped them during inquiry lessons. They were grateful for the extra help and thought of the paraprofessionals as partners. Other frequent inquiry-use teachers longingly remembered having help in the classroom, and discussed the difficulty of implementing inquiry lessons without an extra pair of hands in the classroom.

**State standards.** The frequent inquiry-use teachers recognized the importance of the new state standards to their profession. Lauren, who was a member of an inquiry cohort at a local university, stressed the need to incorporate the state standards into inquiry lessons. She believed that the standards could easily be taught through student inquiry, because they required a depth of student thought and comprehension. Inquiry would be an effective way to teach those skills.

**Teacher experience with inquiry as students.** The teachers in this research study did not have control over whether their own teachers taught them through inquiry lessons, but most of the frequent inquiry-use teachers had experienced inquiry learning as students at some time in school. Based on their interviews, they all experienced frustration and confusion at first, but after some practice, they could see the value of this kind of instruction for student learning. They shared that they found those experiences to be valuable because even though learning through inquiry could be frustrating, they learned first-hand how
effective the instructional methodology could be. In addition, they noted that they were provided with a model of how inquiry works, and in most cases they were required to plan their own inquiry-based lessons as part of the class requirements. This experience supplied a model for the teachers to follow in their own classrooms. The process of inquiry learning was concrete enough so the teachers were comfortable implementing it in their own classrooms.

**Time constraints.** All of the teachers discussed curriculum overload as a large demand on their time. They said that new subjects were often being added to the curriculum, but nothing was ever removed. This caused the teachers to feel overwhelmed. The amount of time available for planning and collaboration was diminished because of so many other demands.

**Characteristics of Infrequent Inquiry-use Teachers**

**Internal Sphere of Influence**

The infrequent inquiry-use teachers discussed the internal sphere of influence themes associated with their instructional decisions. There were several characteristics that the teachers had in common. The teachers who had not experienced inquiry as students, and had difficulty envisioning inquiry in the classroom, were more similar to each other than the teachers who used inquiry infrequently, but had some knowledge of the method. This section describes the themes in the order they were presented in Table 7.

**Beliefs about educational change.** The infrequent inquiry-use teachers were generally more open to educational change than the frequent inquiry-use teachers. Linda was very open to change and viewed it as a natural part of teaching. Cathy said that she thought change was a good thing, and that she felt empowered as a teacher. Alex did not see a need
to change the standards in his district because the students were already doing well on the state tests, but he thought that change was not a bad thing, because it might help increase student scores. Simone wanted teachers to have a stronger voice in educational change, and she did not approve of the way changes were implemented from the top down. She thought that people who had teaching experience should be the ones to determine how to improve education.

**Direct instruction practices.** All of the infrequent inquiry-use teachers discussed the importance of direct instruction. Many of them used direct instruction because they believed it was time efficient. They valued the practice of modeling for their students and explaining material to them to ensure that all students received the same message. The use of direct instruction was conducive to classroom management as well. Most of the teachers expressed a fear of losing control over the class if they tried releasing responsibility for learning to the students. The impact of high stakes testing and the large amount of curriculum to teach were also factors in the teachers’ decisions to employ direct instruction.

**Student engagement.** During the observations, most students were engaged at the beginning of the lessons. They seemed to pay attention and enjoy their learning at first. Later in the lessons, their attention wandered and they became restless after the teachers had been talking for awhile. Despite the lack of concentration, most of the students remained polite and quiet. Most of the students understood their tasks and were able to return to their seats quietly to complete them.

**Teacher emotions.** The infrequent inquiry-use teachers all demonstrated passion for their profession and students. They explained that they planned lessons they thought would reach all of their students, and they appeared to possess good classroom management skills.
However, they expressed less confidence in their teaching overall than the frequent inquiry-use teachers. Some of them feared losing control over the class and learning if they used inquiry in the classroom. They thought that inquiry was too open and unstructured for their students. Some of their statements expressed worry about wasting time, going off on tangents, and asking enough higher level thinking questions to help their students comprehend material at a deep level. Two of the teachers could not envision inquiry learning in the classroom, and did not feel that they could implement it without a model and training. The other two teachers had some knowledge about inquiry learning, and said that they utilized the method at times with their students.

**Teacher knowledge of instructional practices.** There was a notable difference between the two groups of teachers when looking at knowledge of instructional practices. When examining the data for the frequent inquiry-use teachers, it was discovered that each of these teachers expressed a strong interest in science and mathematics. In contrast, the infrequent inquiry-use teachers did not identify science as a favorite content area. Alex was the only infrequent inquiry-use teacher who had taken many courses in science and mathematics. Presumably, he possessed a body of knowledge that would lend itself to implementing inquiry lessons. Simone also mentioned a methods course in which she had designed a science inquiry lesson, but had not taken science courses beyond the requirements for her teaching degree. Cathy was very uncomfortable with science and stated that she wished she did not have to teach the subject. Linda said that she liked science, but she did not feel knowledgeable enough to teach it through inquiry methods.

**Teacher knowledge of inquiry practices.** All of the teachers in this group understood and utilized direct instruction to help their students learn. The teachers who had
experience with inquiry learning implemented it occasionally in a structured way. Those who had not been exposed to inquiry did not possess a clear understanding of what it was or how to implement it. Cathy and Linda were unable to define inquiry learning when they were asked, but they had some knowledge about what it entailed. One of Cathy’s friends was teaching in New York City in a school that valued and utilized inquiry learning, and Cathy learned that the inquiry lessons were highly effective. She said that she would like to try inquiry if she could observe a model lesson. Linda was not ready to try inquiry at the time of the interview, saying that she was in the midst of implementing readers’ workshop and felt overwhelmed with new learning. She said that she might be willing to try inquiry in the future, but like Cathy she wanted to be able to observe an inquiry lesson in action.

Simone and Alex mentioned inquiry learning as part of their styles, and their lessons demonstrated some evidence of structured inquiry at times. Based on their comments, these teachers appeared to have some understanding of inquiry. Alex used some student-to-student discussion and higher order thinking questions in his lesson. The lesson was teacher-centered, but Alex tried to facilitate some discussion. Simone used some structured inquiry in her lesson, utilizing social learning and some higher order thinking questions, but overall the instruction was teacher-directed. She identified herself as a flexible, confident free-thinker, and reported that she used inquiry during about half of her instructional time. She thought that people who were unwilling to try new approaches were less outgoing and more of what she termed the home-body type.

Two of the infrequent inquiry-use teachers said that they did not often ask students to conduct research, if at all. Cathy explained that her students looked up information when they had computer time at the library, and would learn to ask inferential questions in reading
and writing. Linda said that she did not have students engage in research in third grade. Alex asked his students to conduct research at times. He discussed social learning, and how engaged his learners were in group discussions as a form of inquiry-based teaching. Simone explained a research process in which she led the students through a study of the states. She explained that later in the year she would have the students learn to come up with big questions, and then go off to do their own research.

**Teacher pedagogical beliefs.** The infrequent inquiry-use teachers said that they taught students the way that they believed children learn. Some of them thought that inquiry was an unguided, open, unstructured method of teaching, and they did not believe that it was developmentally appropriate for their students. They relied on direct instruction because they thought it was an efficient and effective way to teach students. They were unsure whether inquiry learning held enough benefits for students to make it worth trying.

**Teacher problem-solving style.** The infrequent inquiry-use teachers exhibited a variety of problem-solving preferences. Their preferences were a mix of Explorers, Developers, and Moderates. Problem-solving style did not appear to influence teacher instructional choices.

**Teaching style.** When describing their teaching styles and personal beliefs in the interviews, the infrequent inquiry-use teachers described themselves as optimistic, organized, compassionate, and eager to provide differentiated lessons to meet student needs. All of the infrequent inquiry-use teachers expressed the desire to help their students to excel. Alex described himself as a strong leader and inquiry teacher. He was very knowledgeable about inquiry education, and he described himself as a proponent of social learning to enhance student growth. At the conclusion of the interview, Alex honestly expressed the fear of
going off on a tangent and wasting precious learning time when employing inquiry techniques. Alex said he often spent time reflecting upon this apprehension as a legitimate barrier to more frequent use of inquiry in the classroom.

Cathy described herself as patient, organized, structured, and compassionate. She identified direct instruction as her preferred teaching method, and demonstrated it throughout her lesson. Linda, a self-described optimist, said that she wanted to empower students, and she believed that it was crucial to student success to have a personal relationship with the teacher. She thought that if students knew the teacher cared about them, they would be more secure and ready to take risks. At the time of the interview, Linda was learning a new method of teaching reading, and she expressed a desire to implement readers’ workshop correctly before learning any other unfamiliar teaching methods such as inquiry.

Simone said that she was always looking for new ideas and strategies for her students. She said that she thought she used direct instruction and inquiry instruction equally in her teaching. She liked to differentiate the presentation of new material for her students through multi-modal methods to reach every student. Simone said that her flexibility was helpful in her teaching. In her lesson, she demonstrated direct instruction and some evidence of structured inquiry instruction.

**Types of questions posed.** The infrequent inquiry-use teachers posed a variety of questions to their students. Many of the questions had correct answers and were intended to help students review material, both before and after teaching. All of the teachers asked a number of higher-order thinking questions as well. For example, in his lesson on *Crash* (Spinelli, 1996), Alex asked his students to discuss the main character’s personality and motives for his actions. Alex continued to press his students, causing many of them to start
making connections and develop a deeper understanding of the character. The difference between the questions asked by this group and those asked by the frequent inquiry-use teachers was in the number of higher-order questions. The frequent inquiry-use teachers asked many more open-ended questions than the infrequent inquiry teachers.

**Characteristics of Infrequent Inquiry-use Teachers**

**External Sphere of Influence**

The factors under the external sphere of influence affected the instructional choices of teachers who did not implement inquiry frequently. These elements were age and experience, collaboration, professional development, educational change, and teachers’ experiences with inquiry as students.

**Age and experience.** The teachers who infrequently used inquiry were younger and less experienced as a group than the teachers who frequently implemented inquiry. The researcher did not control for age or experience, but this finding was presented as a matter of interest. A larger study or a different sample could produce different results.

**Collaboration.** The infrequent inquiry-use teachers valued collaboration as a means for problem-solving and sharing ideas between teachers. Linda and Simone particularly appreciated the opportunity to listen to others’ opinions. Linda believed that her peers helped her to understand many aspects of a problem because she thought she tended to see only the good side, and needed help to consider possible negative outcomes. Simone lamented the lack of time for collaboration, but was gratified that her new principal was finding ways for teachers to meet. She believed that collaboration was crucial to implementing new methods of teaching. Cathy felt empowered by the opportunity to collaborate about the changes in the language arts curriculum in her district. Alex placed a great deal of emphasis on
collaboration for teachers, and also for students. He felt it was important to teach students how to interact collaboratively and to learn from one another.

**Mandated change.** In this study, the infrequent inquiry-use teachers were more likely to accept educational change as part of being a teacher than the frequent inquiry-use teachers. Two of them accepted the new state-mandated changes as an opportunity to improve their teaching through the use of the upcoming Common Core State Standards (CCSS). Their overall comments indicated openness to educational change.

The infrequent inquiry-use teachers cited other topics related to implementation of new changes. Topics included curriculum overload, too much change at one time, personal life issues, and the amount of time it would take to plan and prepare for inquiry lessons. When faced with learning to implement inquiry in the classroom, the teachers needed guidance to gather materials, plan lessons, and be able to visualize it in action. The lack of program support in terms of materials and training prevented some of the teachers from trying inquiry.

**Mandated testing.** Mandated testing was accepted as part of the job in this group of teachers. They wanted to use the new standards to help their students to achieve well on the state tests. They did acknowledge experiencing a certain amount of pressure to cover content and curriculum to accomplish this goal. The infrequent inquiry-use teachers did not hold the same strong opinions against mandated, high-stakes testing that the frequent inquiry-use teachers did.

**Parent feedback and peer pressure.** These two themes did not impact the infrequent inquiry-use teachers. None of them described experiences with parent feedback about their teaching, or about peer pressure from colleagues.
**Professional development.** All of the infrequent inquiry-use teachers discussed the need for professional development that would serve as a model for how inquiry learning is conducted in the classroom. Cathy was influenced by her friend who was observing inquiry education in New York, and expressed the desire to try it herself if she could watch inquiry lessons in action. Linda also thought that it was difficult to imagine inquiry in the classroom, and that she would need training in how to fit it into the curriculum and the school day. Simone noted that practical, on-going professional development would be very helpful to teachers new to inquiry learning. Alex thought that a coach would help teachers to envision and implement inquiry education. Overall, professional development opportunities were considered vital to teacher acceptance and implementation of inquiry in the classroom.

**Program support.** All of the infrequent inquiry-use teachers said that they wished for more materials with which to teach, and they wanted these materials to be accessible to their students in terms of reading and ability levels. Paraprofessionals were also on their wish-lists. For example, Cathy talked about how much she appreciated the extra help when she had a paraprofessional in her classroom. She also discussed the need for content area coordinators or coaches to help teachers to plan lessons for their students. This was also mentioned as a necessity for feeling confident enough to try inquiry in the classroom.

**State standards.** The infrequent inquiry teachers were in the process of learning about the new state standards. As a group, they were hopeful that the standards would help them to improve their classroom practice, and ultimately help students to be successful learners. Cathy and Alex said that they thought the standards would empower teachers and raise their expectations of students.
Teacher experience with inquiry as students. The infrequent inquiry-use teachers varied in the amount of inquiry learning they had experienced as students. Cathy had no experience in her own education, and consequently had no vision of how to implement inquiry instruction. Linda described a fuzzy memory of working backwards to solve a problem once, but she too could not envision inquiry learning. These two teachers did not think that their lack of experience with inquiry learning prevented them from utilizing it as an instructional method, although they expressed a desire to observe inquiry lessons.

Alex described inquiry as something he had learned in a college science course. He did have an understanding of what inquiry entailed and said that he employed the methodology in his teaching, even though this form of instruction was not witnessed during the one observation. Simone recalled a methods course in which she participated in inquiry learning in school. She understood that the purpose of the college course was to demonstrate for teachers how to implement inquiry learning in their own classrooms. Alex and Simone demonstrated some elements of inquiry instruction in their lessons, although the lessons were not considered proficient or exemplary on the observation rubric.

Time constraints. Although the infrequent inquiry-use teachers were not bothered by change, they did experience a time crunch due to the demands on their time. For instance, they said that they did not have enough time in the day to plan or reflect on their practice. Some of them did this work at home on their own time. One teacher, Linda, said that her young family did not allow for much time to work at home. This was very frustrating to her because she said that she already worked 50 to 60 hours per week, and still it was not enough time to accomplish all of her teaching tasks.
<table>
<thead>
<tr>
<th>Internal Sphere Themes</th>
<th>Frequent Inquiry-use Teachers</th>
<th>Infrequent Inquiry-use Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IS Beliefs about educational change</td>
<td>Change was inevitable, too much change at one time, unrealistic expectations from state, some negative feelings about testing and new CCSS, no voice</td>
<td>Generally positive and open to changes, too much at once, CCSS important to teaching, may improve education, voice, empowerment</td>
</tr>
<tr>
<td>2. IS Direct instruction practices</td>
<td>Direct instruction necessary to teach some concepts and skills, useful to teach process of inquiry, used on a daily basis</td>
<td>Time efficient, developmentally appropriate, modeling teacher expectations, used many times daily</td>
</tr>
<tr>
<td>3. IS Student engagement</td>
<td>Students involved in inquiry lessons, student enjoyment in learning, generally high student attention</td>
<td>Students listening to teacher, students cooperative, quiet, attention inconsistent</td>
</tr>
<tr>
<td>Internal Sphere Themes</td>
<td>Frequent Inquiry-use Teachers</td>
<td>Infrequent Inquiry-use Teachers</td>
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</tr>
<tr>
<td><strong>4. IS Teacher emotions</strong></td>
<td>Enjoyment of science, confidence implementing inquiry, passion for teaching, strong opinions about high-stakes testing, risk taking important, teacher mistakes were teachable moments</td>
<td>Generally, did not enjoy science, less confident implementing inquiry, passion for teaching, acceptance of high-stakes testing, fear of losing control over class, fear of making mistakes in front of class</td>
</tr>
<tr>
<td><strong>5. IS Teacher knowledge of instructional practices</strong></td>
<td>Differentiation, direct instruction, data-driven decision making, inquiry-based instruction, content knowledge and continued learning (science), scaffolding student learning, clear research process in classroom</td>
<td>Bloom’s Taxonomy, differentiation, direct instruction, limited knowledge of inquiry instruction, some had content knowledge (science), scaffolding student learning, science fair, no clear research process in the classroom</td>
</tr>
</tbody>
</table>
Table 9

*Comparison of Internal Sphere (IS) Themes for Frequent and Infrequent Inquiry-use Teachers (continued)*

<table>
<thead>
<tr>
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<th>Frequent Inquiry-use Teachers</th>
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</tr>
</thead>
<tbody>
<tr>
<td>6. IS Teacher knowledge of inquiry practices</td>
<td>Could envision inquiry in the classroom, knowledge of inquiry as a continuum, inquiry more than hands-on lessons, exploration, student-centered, social learning, shared discussion between teacher and students, teacher as facilitator, continuum of inquiry, structure in inquiry, student choice, hands-on learning part of inquiry</td>
<td>Could not envision inquiry in the classroom, thought inquiry was unstructured and too open, thought hands-on lessons were inquiry, two teachers had no inquiry knowledge or did not recognize elements of inquiry in their teaching, two teachers had some knowledge of inquiry and expressed interest in using it more</td>
</tr>
<tr>
<td>7. IS Teacher pedagogical beliefs</td>
<td>Inquiry benefits students, builds comprehension and thinking skills, builds 21st Century skills, inquiry developmentally appropriate, inquiry more effective than direct instruction, direct instruction still necessary</td>
<td>Some did not understand the benefits of inquiry to student learning, inquiry not developmentally appropriate, direct instruction more effective than inquiry</td>
</tr>
</tbody>
</table>
## Table 9

**Comparison of Internal Sphere (IS) Themes for Frequent and Infrequent Inquiry-use Teachers (continued)**

<table>
<thead>
<tr>
<th>Internal Sphere Themes</th>
<th>Frequent Inquiry-use Teachers</th>
<th>Infrequent Inquiry-use Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. IS Teacher problem-solving style</td>
<td>No discernible pattern</td>
<td>No discernible pattern</td>
</tr>
<tr>
<td>9. IS Teaching style</td>
<td>Flexible teachers, not afraid of making mistakes, risk-takers, older, more experienced, passionate about teaching</td>
<td>More traditional teachers, rule-followers, younger, less experienced, enthusiastic, passionate about teaching</td>
</tr>
<tr>
<td>10. IS Types of questions posed</td>
<td>More higher-order than lower-order questions</td>
<td>More lower-order than higher-order questions</td>
</tr>
</tbody>
</table>
Table 10

Comparison of External Sphere (ES) Themes for Frequent and Infrequent Inquiry-use Teachers

<table>
<thead>
<tr>
<th>External Sphere Themes</th>
<th>Frequent Inquiry-use Teachers</th>
<th>Infrequent inquiry-use Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ES Age and experience</td>
<td>Mean age 40, mean number of years teaching 11</td>
<td>Mean age 32, mean number of years teaching 6</td>
</tr>
<tr>
<td>2. ES Collaboration</td>
<td>Necessary to support inquiry teaching, work together to make sense of CCSS and high-stakes tests, help other teachers begin using inquiry, meet with paraprofessionals and specialists</td>
<td>Used for problem-solving, sharing opinions, discussing student needs, important for teachers and students, importance of TEAM mentoring program to new teacher success</td>
</tr>
<tr>
<td>3. ES Mandated change</td>
<td>Time constraints, need better program support, peer pressure, too much at one time</td>
<td>Time constraints, need better program support, too much at one time</td>
</tr>
</tbody>
</table>

237
<table>
<thead>
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<th>Infrequent inquiry-use Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. ES Mandated testing</td>
<td>Technology problems, too much time preparing, pressure on students may be harmful</td>
<td>Tests were part of the norm, time spent on CCSS and test preparation valuable to improve teaching and learning</td>
</tr>
<tr>
<td>5. ES Parent feedback</td>
<td>Two teachers experienced pressure to teach content more quickly, keep up with other classes</td>
<td>None</td>
</tr>
<tr>
<td>6. ES Peer pressure</td>
<td>Three teachers felt pressure to conform to traditional teaching from colleagues, discomfort due to criticism from colleagues</td>
<td>None</td>
</tr>
</tbody>
</table>
Table 10

Comparison of External Sphere (ES) Themes for Frequent and Infrequent Inquiry-use Teachers (continued)

<table>
<thead>
<tr>
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<th>Infrequent inquiry-use Teachers</th>
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</thead>
<tbody>
<tr>
<td>7. ES Professional development</td>
<td>Teachers as life-long learners, lack of availability of training for inquiry teaching, need for coaching model, practical for ease of implementation in classroom</td>
<td>Need for modeling to envision inquiry in classroom, training on how to implement inquiry and how to fit it into schedules, gradual and on-going learning</td>
</tr>
<tr>
<td>8. ES Program support</td>
<td>Lack of appropriate materials, need for support from paraprofessionals or parents in classroom, importance of a cache of materials to make inquiry implementation more manageable</td>
<td>Lack of appropriate materials, need for more materials, need for a coach to assist teachers with inquiry implementation, need for support from paraprofessionals and specialists</td>
</tr>
</tbody>
</table>
Table 10

*Comparison of External Sphere (ES) Themes for Frequent and Infrequent Inquiry-use Teachers (continued)*

<table>
<thead>
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<th>Infrequent inquiry-use Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. ES State standards</td>
<td>CCSS may help improve teaching and learning, one teacher discussed how to incorporate them into inquiry lessons, mixed opinions on effect on students</td>
<td>Positive about benefits of CCSS, hopeful that teaching and learning will improve as a result</td>
</tr>
<tr>
<td>10. ES Teacher experience with inquiry as students</td>
<td>All experienced inquiry as students or learned about inquiry working with a knowledgeable peer, experiences were in science classes</td>
<td>One experienced inquiry as a student in science, one had hands-on experiences independent of inquiry, two had no experience</td>
</tr>
<tr>
<td>11. ES Time Constraints</td>
<td>Curriculum overload, lack of time to plan and reflect on teaching, testing consumed teaching time</td>
<td>Curriculum overload, lack of time to plan, conflict with time for personal lives</td>
</tr>
</tbody>
</table>
Question 4: Catalysts and Barriers to Teacher use of Inquiry Methods

The interviews and observations conducted in this study yielded a great deal of information. Coding and recoding allowed themes to emerge, which enabled the researcher to identify several catalysts and barriers to teacher use of inquiry. This section discusses the findings of this investigation in regard to the catalysts and barriers that influence teachers when making instructional decisions about inquiry. The catalysts are delineated and explained first, and then the barriers are discussed (see Tables 11 and 12 for catalysts and barriers). The catalysts and barriers are separated into internal and external spheres of influence.

Catalysts and Barriers

Internal Sphere of Influence: Catalysts

Many catalysts to teacher use of inquiry in the classroom were identified by the subjects in this study. The catalysts are discussed according to the themes that emerged. They appear in the same order as in Table 7.

Beliefs about change. The discussions regarding state-mandated change brought out some strong feelings. Much of the discussion about educational change revolved around the amount of high-stakes testing currently required by the state. The frequent inquiry-use group believed that the testing demands were too stringent and that students needed more time for learning as compared to test preparation. The infrequent inquiry-use group believed that the new standards and testing demands could help them to become better teachers. Although the frequent inquiry-use teachers were more wary of change than the infrequent group, but essentially, change did not function as a catalyst to teacher use of inquiry.
Direct instruction practice. If teachers realized that inquiry implementation was complemented by direct instruction, perhaps they would not be so hesitant to try it. All of the teachers in both groups discussed their use of direct instruction. Teachers who were more comfortable with direct instruction would benefit by starting inquiry implementation gradually, according to Connie, Pam, Kristin and Lauren.

Student engagement. The students involved in inquiry lessons were more engaged in their learning than students experiencing a traditional method, overall. Inquiry learning resulted in higher student attention, participation, and engagement. This result is a catalyst to teacher use of inquiry because teachers who understood these benefits utilized inquiry as often as they could. Teachers who are new to inquiry should observe the inquiry model in action to build confidence in its ability to engage students.

Teacher emotions. Confidence in oneself in teaching in general, and inquiry in particular, appeared to influence teachers to implement inquiry. Teachers who expressed confidence shared that they felt comfortable making mistakes and not knowing answers in front of their students. This self-assurance may have liberated the teachers from the fear of erring in front of students, and allowed them to take the risk of learning how to implement inquiry in the classroom.

Teacher knowledge of instructional practices. The teachers who enjoyed science were the ones who were most willing to implement inquiry. They believed in on-going, life-long learning and investigated the topics their students were working on as researchers. Understanding inquiry and its methods was a catalyst for teachers to use inquiry. The frequent inquiry-use teachers could visualize the lesson ahead of time, and they conducted research with their students and had a research process already in place.
**Teacher knowledge of inquiry practices.** The teachers who had at least a basic understanding of inquiry were more likely to implement it than teachers who did not. Teachers needed a vision of how inquiry is conducted in the classroom in order to use it in their teaching. Inquiry is not easy to envision without a model or coaching of some type. Training in inquiry learning and teaching must be provided if teachers unfamiliar with the practice are to employ it as part of their teaching repertoire.

**Teacher pedagogical beliefs.** The teachers who believed in the benefits of inquiry for their students were likely to implement it in their classrooms. The ability to envision inquiry lessons was also paramount to teachers when attempting to implement inquiry. Inquiry teachers used their mistakes or lack of on-the-spot answers to teach their students how to ask questions and find the answers. The knowledge that inquiry was more than hands-on lessons also resulted in teachers using inquiry effectively.

**Teacher problem-solving style.** Problem-solving preferences were not influential in the teachers’ decisions to implement inquiry. This is a hopeful finding because teachers with all of the problem-solving styles were utilizing inquiry in their classrooms. Problem-solving style preferences did not appear to inhibit teachers from implementing a complicated, sophisticated teaching method, so it may be speculated that all teachers can learn to implement inquiry regardless of how they prefer to solve problems.

**Teaching style.** According to Simone, it is easier for teachers who are risk-takers and what she termed free thinkers to implement new or unfamiliar strategies in the classroom. She noted that traditional teachers may be very comfortable in teaching the way they were taught. Even though Simone was placed in the infrequent inquiry-use group, she
did exhibit knowledge about inquiry methods and said that she wanted to increase her use of inquiry in the future.

**Types of questions posed.** Teachers who implemented inquiry tended to ask a greater number of higher-order thinking questions. The activities and discussions that occurred in inquiry lessons encouraged the use of higher-order thinking. Teachers who did not ask as many higher-order thinking questions tended not to implement inquiry.

**Internal Sphere of Influence: Barriers**

Many of the barriers to teacher use of inquiry were the inverse of the catalysts. Once some of the barriers are resolved, they could easily become catalysts to making inquiry implementation easier to perform and comprehend. The barriers are presented according to the spheres of influence under which they fall, and in the same order that they appear in Table 7.

**Beliefs about change.** Educational change was a barrier to teacher use of inquiry when those changes impacted time for teaching. All of the teachers in both groups agreed that mandatory, high-stakes testing demanded test preparation time, thus impacting time available for teaching. The teachers who did not have a strong grasp of inquiry were unwilling to spend precious learning time educating themselves about inquiry or trying out time-consuming lessons when so much was at stake. They felt that it was easier to incorporate the state standards in direct instruction.

**Direct instruction practice.** Teachers who thought that direct instruction was the right way to teach were unlikely to implement inquiry lessons. They believed that direct instruction was more efficient, covered more content quickly, and helped students to achieve
o tests. They were comfortable with the classroom management associated with direct instruction, noting that they feared losing control of the class if they tried inquiry methods.

**Student engagement.** The teachers who did not implement inquiry believed that their students were engaged in their learning. The students were polite and quiet during the lessons that were observed, but their attention did wander after a few minutes of listening to the teacher. The infrequent inquiry-use teachers thought that inquiry was an unstructured way to teach, and that their students would not pay attention. However, in the case of the observations conducted in this study, students involved in inquiry were more attentive overall.

**Teacher emotions.** The teachers who demonstrated less confidence in inquiry teaching, even when they were doing their jobs well, were less likely to implement it. This supports the finding that teachers with little knowledge or experience of inquiry learning find it difficult to envision and put into practice. The infrequent inquiry-use teachers stated that they would need practical training and coaching to develop confidence in implementing what they considered to be a difficult instructional practice. Lack of confidence in inquiry teaching was a barrier to teacher readiness to try inquiry in the classroom.

**Teacher knowledge of instructional practices.** The teachers who were less knowledgeable about science and research were less willing to implement inquiry lessons than teachers with more extensive knowledge in the area of scientific studies and research. Teachers who did not enjoy science or did not have a clear research process in place were also unlikely to attempt inquiry in their classrooms. If teachers were not willing or able to continue learning about the content that interested their students, it appears that their willingness to implement inquiry was reduced. Additionally, it was very difficult, if not impossible, for teachers to envision inquiry implementation if they had never observed a
model. This lack of vision prohibited teachers from employing inquiry. Teachers find it difficult to utilize a method that they do not understand. A dearth of knowledge about content and inquiry practice served as a barrier to teacher use of inquiry.

**Teacher knowledge of inquiry practices.** The teachers who did not know what inquiry was about were unlikely to attempt it in their classrooms. They explained that they could not envision it and that it seemed very time intensive. They did not know where to begin, and said they needed a model and coaching if they were going to use inquiry as a teaching method.

**Teacher pedagogical beliefs.** The teachers who understood the benefits of inquiry for student learning were likely to use inquiry more frequently in their classrooms. All of the teachers taught according to their beliefs about how students learn, and when inquiry is a part of that paradigm teachers tended to implement it more often. Lack of knowledge and belief in the effectiveness of inquiry was a barrier to its implementation.

**Teacher problem-solving style.** In this study, problem-solving style was not a catalyst or a barrier to teacher use of inquiry. Teachers in both groups possessed a variety of problem-solving styles. Any teachers should be able to implement inquiry regardless of their problem-solving style preferences with the appropriate training.

**Teaching style.** One of the barriers to teacher use of inquiry under this theme was the teachers’ fear of making mistakes and not knowing answers in front of the class. Although some teachers were willing to try inquiry with their classes, they were uncomfortable with the increased student responsibility for learning. They were afraid that students would go off-topic in discussions and waste valuable learning time. They also feared going off on tangents of their own as they tried to follow and answer the students’
questions. Several teachers also believed that direct instruction would be a more efficient way to deliver content.

**Types of questions posed.** Teachers who did not understand the taxonomy of learning did not tend to ask as many higher-order thinking questions as teachers who did. The lack of knowledge about questions that push thinking skills was a barrier to teacher implementation of inquiry in this study.

**Catalysts and Barriers**

**External Sphere of Influence: Catalysts**

**Age and years of teaching experience.** The teachers in this study who used inquiry frequently were older and more experienced in teaching than the teachers who did not use inquiry frequently. They all used inquiry methods and most of them had experienced inquiry in high school or college. This finding proved to be unexpected and interesting, but the sample was small and the researcher did not control for age or experience, so it is difficult to attribute inquiry use to these factors.

**Collaboration.** All of the teachers participating in this research study agreed that collaboration is extremely important to teachers and their performance. Collaboration acted as a catalyst for inquiry use by providing teachers with support and practical help. The frequent inquiry-use teachers expressed a desire to coach other teachers new to inquiry, and even gathering materials and planning lessons with them.

**Mandated change.** The teachers in both groups said that access to appropriate materials, training in CCSS implementation and better program support would all be catalysts to teachers’ decisions to implement inquiry. The infrequent inquiry-use teachers
thought that the new state standards would be a positive way to improve teaching and learning.

**Mandated testing.** Mandated, high-stakes testing did not function as a catalyst in this study (see barriers).

**Parent feedback.** The teachers did not mention parent feedback as a catalyst to teacher use of inquiry (see barriers).

**Peer pressure.** Peer pressure was not considered a catalyst to teacher use of inquiry (see barriers).

**Professional development.** Professional development opportunities that provided practical strategies and coaching to help teachers understand and envision inquiry in the classroom was another catalyst to teacher use of inquiry. Both groups believed that coaching should be part of the model so that teachers could have scaffolding support and a professional resource to assist them with questions. In addition to training teachers about how to apply inquiry in the classroom, the teachers thought that guidance to fit inquiry into their schedules and how to use it with the curriculum would be helpful with inquiry implementation.

**Program support.** Teachers who felt that they had enough appropriate materials to conduct inquiry lessons were more likely to do so than teachers who did not. The frequent inquiry-use teachers said that maintaining a cache of materials to use in inquiry lessons would be a catalyst for reluctant teachers, because it would lessen the amount of preparation time. Having plenty of help in the classroom was another catalyst that emerged under program support.

**State standards.** One frequent inquiry-use teacher said that the new state standards lent themselves to inquiry lessons because of the level of thinking required to meet them.
She thought that the standards could be seen as a catalyst to teacher inquiry use if teachers understood how easily inquiry lessons could be planned around them.

**Teacher experience with inquiry as students.** Three of the five frequent inquiry-use teachers who employed inquiry in this study had some type of experience with it when they were in school. One had experienced hands-on lessons that she thought were valuable, and one had learned about inquiry implementation from her co-teacher. One of the infrequent inquiry-use teachers had experienced inquiry learning in college, and although he did not implement inquiry in the classroom at the time of this study, he expressed interest in doing so in the future.

Even if the inquiry learning experience was frustrating due to lack of guidance from the instructor, the teachers who learned through inquiry developed a belief in its benefits for students. The teachers who had no experience with inquiry when they were students in school could not envision or define it. Therefore, teacher experience with inquiry as students was found to be a catalyst to teacher use of inquiry.

**Time constraints.** Time constraints did not emerge as a catalyst to teacher use of inquiry (see barriers).

**External Sphere of Influence: Barriers**

Several factors in the external sphere of influence served as barriers to teacher use of inquiry. Those factors were not under the control of the teacher. Rather, they were controlled by external sources such as the state or the school administration. Some barriers, such as lack of time, were more difficult to remedy than barriers such as access to professional development opportunities or time for collaboration. Barriers to the frequent implementation of inquiry teaching are described in this section.
**Age and years of teaching experience.** In this research study, being relatively inexperienced and young were barriers to teacher use of inquiry methods. Once again, it is not possible to attribute infrequent use of inquiry methods to these factors, because age and years of experience were not controlled for in this investigation. This finding may merely be an anomaly particular to this group of teachers.

**Collaboration.** Lack of collaboration between teachers was a barrier to teacher implementation of inquiry. Without this time, teachers had difficulty trouble-shooting and discussing students and instructional practices. Unless teachers had time to collaborate with others about problems and ideas, it was difficult for them to assist each other. Lauren, one of the frequent inquiry-use teachers, noted that at her previous school she had no one with whom to collaborate. She remembered wishing for a partner or a team so she could discuss ideas, and give and receive support in her efforts to implement inquiry. As a group, the frequent inquiry-use teachers expressed the desire to help other teachers who were new to inquiry, but they found it difficult without adequate time to meet.

**Mandated change.** Many teachers thought that there were too many changes in education at one time. They cited the new standards, new content, new programs to teach the content, and lack of direction from the state. This was a barrier to teacher use of inquiry, because some teachers felt overwhelmed, and if they were not already implementing inquiry, a change in practice seemed like too much more for them to handle. The teachers were inundated with new curriculums, but they bemoaned the fact that nothing was ever removed from the curriculum.

**Mandated testing.** All of the teachers in both groups thought that the high-stakes, state mandated testing programs consumed too much teaching time. Some of the infrequent
inquiry-use teaches said that this prevented them from using inquiry in the classroom because inquiry lessons take longer to deliver than traditional lessons. They were anxious that they would run out of time before the testing and be unable to complete the content they were supposed to teach. The frequent inquiry-use teachers said that they thought the pressure on students caused by testing was not developmentally appropriate and that they would rather spend teaching time on inquiry lessons than test preparation.

**Parent feedback.** Connie and Pam experienced a problem with parents who were unhappy that their twin children were not receiving the same instruction on a daily basis. They thought that the teachers were not going to have time to teach all of the necessary content before testing. Connie and Pam felt pressure to conform to the rest of the grade level, which they resisted. However, both teachers explained that they were uncomfortable knowing that parents felt that way.

**Peer pressure.** Three of the frequent-inquiry teachers said that they had been pressured by colleagues to stop teaching through inquiry because it was different from the way everyone else taught. One of the teachers was told by a senior colleague that she did not know how to teach reading because she used inquiry to teach comprehension. All three teachers felt discomfort, and thought that some teachers might stop implementing inquiry because of comments by other teachers, although they themselves continued because they believed in the benefits of inquiry.

**Professional development.** The lack of professional development opportunities to learn about inquiry was a major barrier to teacher implementation. The teachers unfamiliar with inquiry did not have a model to follow, and there was no coach to help them learn and improve their pedagogical skills. Teachers wished for professional development that was
practical, with very little theory, in order to agree to try inquiry. Some teachers commented that they would like training in how to use inquiry in the curriculum, and how to fit it into their schedules.

**Program support.** Lack of program support was identified as a barrier to teacher use of inquiry. The participants in this study thought that a dearth of materials and support personnel acted as an impediment to inquiry use. They discussed the inappropriate reading and ability levels of materials which they did have, and said that teachers new to inquiry might avoid it because they had to gather materials on their own outside of school. If teachers were expected to learn an unfamiliar method, they needed the proper support to provide them with positive experiences with inquiry implementation.

**State standards.** Most of the teachers thought that the new state standards would be a barrier to teacher use of inquiry because of the amount of planning time, test preparation time, and testing pressure. One teacher, Lauren, thought that the state standards could easily be taught through inquiry, but she was in the minority.

**Teacher experience with inquiry as students.** Lack of experience with inquiry as a student also emerged as a barrier to teacher use of inquiry. Teachers who had never been taught through inquiry methods had no experience or model for implementing it in their own classrooms. Without a vision or the experience of grappling with inquiry as a learner, it was nearly impossible for teachers to implement inquiry in their own classrooms.

**Time constraints.** This theme was brought up repeatedly in the interviews as a barrier to teacher use of inquiry. The teachers mentioned the overwhelming amount of curriculum they had to teach, in addition to taking time for test preparation and the pressure to get everything done on time. One teacher in particular discussed the impact that teaching
had on her personal life, because she had so much paperwork to do in addition to other
teaching duties. The teachers were frustrated by the effect of time on teaching, and thought
that most teachers would avoid inquiry lessons because they took so much more time than
direct instruction.

**Question 5: Results of VIEW: An Assessment of Problem-solving Style**

The problem-solving styles instrument, *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007), was chosen to examine whether teacher use of inquiry was influenced by problem-solving style preferences. Because inquiry is closely related to solving problems, it was postulated that preferred problem-solving style might relate to whether a teacher might be prone to using it. A discussion of *VIEW: An Assessment of Problem-solving Style* results is followed by Tables 12 and 13, which display the scores for each participant, along with the means and standard deviations for the two groups when taken independently.

The purpose of *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007) in this study was to identify the preferred problem-solving styles of the two groups of teachers. The researcher examined the results to ascertain whether there were any common patterns or traits among the teachers that could provide insight into why some teachers choose to implement inquiry methods frequently, while other teachers do not. The following discussion explains how the instrument was scored and the meaning of the results.

Each participant completed *VIEW: An Assessment of Problem-solving Style* before the interview. The researcher tallied the scores for each dimension and compared them to the range of scores provided by the authors (Treffinger, et al., 2007). Each teacher was placed in the appropriate place on the dimension continuums. Next, the results were analyzed by using
the sample means and standard deviations. Teachers whose scores fell one or more standard deviations outside of the mean were considered to have a definite preference for a particular style.

Once the entire group was analyzed, the results were divided into the two groups: frequent inquiry-use and infrequent inquiry-use teachers. The means and standard deviations were computed for each group, and the teachers scoring one or more standard deviations outside of the mean were considered to have a definite preference for a particular style. The researcher examined the data this way to see if either analysis provided insight into the influence of problem-solving style on teacher instructional decisions. A discussion of each dimension and its results follows Tables 11 and 12, which illustrate the data.
Table 11

Results of VIEW Scores for the Sample of Frequent and Infrequent Inquiry-use Teachers

<table>
<thead>
<tr>
<th>Subject</th>
<th>Frequent Inquiry Users</th>
<th>Infrequent Inquiry Users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Connie</td>
<td>Pam</td>
</tr>
<tr>
<td>Orientation to Change</td>
<td>73</td>
<td>92</td>
</tr>
<tr>
<td>(Sample mean 83,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sample SD 16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manner of Processing</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>(Sample mean 27,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sample SD 10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ways of Deciding</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>(Sample mean 32,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sample SD 9)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Band of error confidence interval = 68%. SEM: OC = 6, MP = 3, WD = 3. The dimension means and standard deviations (SD) consist of the sample group means and standard deviations. The standardization means were OC = 74.6, MP = 30.1, WD = 34.6. The standardization SDs were OC = 15.8, MP = 9.2, WD = 8.5. The standardization ranges were OC 18-126, MP 8-56, WP 8-56.
Table 12

*Independent Means and Standard Deviations for the Frequent and Infrequent Inquiry-use Groups*

<table>
<thead>
<tr>
<th>Group</th>
<th>OC Mean</th>
<th>OC Standard Deviation</th>
<th>MP Mean</th>
<th>MP Standard Deviation</th>
<th>WP Mean</th>
<th>WP Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequent Inquiry</td>
<td>83</td>
<td>17</td>
<td>28</td>
<td>14</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>Infrequent Inquiry</td>
<td>84</td>
<td>18</td>
<td>25</td>
<td>5</td>
<td>32</td>
<td>5</td>
</tr>
</tbody>
</table>

Because a test score contains error, it is an estimate of an individual’s true performance. The reliability and standard deviation of a set of scores can be used to estimate a range of scores that includes an individual’s true scores. This range can be based on varying levels of confidence, such as 68% or 99%. Table 9 displays a band of error around the participants’ test scores using a 68% interval. This means that chances are 68 out of 100 that the teacher’s true score on the three dimensions of *VIEW: An Assessment of Problem-solving Style* would be expected to fall within the range of the two scores (Standard Error of Measurement, Web log post, 2012).

**Orientation to Change Dimension (OC)**

According to the *VIEW* Technical Manual (Selby, Treffinger, & Isaksen, 2008), each dimension has a range and a mean. The range for Orientation to Change (OC) was 18 to 126. The mean score for the sample in this study was 83. The participant scores in this study ranged from 66 to 108. The mean score would place the subject in the Moderate problem-
solving style range, favoring neither Explorer nor Developer. Lower scores indicated a tendency toward preferring the Explorer problem-solving style, and higher scores toward preferring the Developer problem-solving style. Individuals who prefer the Moderate problem-solving style may “appreciate both the need for detail and stability, and the need to change perspective” (Treffinger, et al., 2007, p.11). Moderates sometimes bridge the gap between the Developers and Explorers by helping them to see each other’s point of view. For the purposes of this study, Connie, Kelly, Alex, and Linda were considered to score moderately on OC. Connie was part of the frequent inquiry-use teachers’ group, but Alex, Kelly, and Linda were infrequent inquiry-use teachers, signifying that there may not be a link between having a Moderate style preference and deciding to implement inquiry lessons.

Scores that were one or more standard deviations above the mean indicated a preference for the Developer style. Developers “readily generate practical and useful ideas that are new within the existing paradigm” (Treffinger, et al., 2007, p. 11). Developers appreciate structure, authority, organization, and like to be attentive to details (Treffinger, et al., 2007). Developers need to be patient when Explorers are offering ideas that are novel, and try to stay open to unusual solutions. They may have difficulty when asked to consider far-fetched ideas, which is where the gap between Developers and Explorers lies, and where the Moderates can help to smooth over conflicts between the two types. The teachers scoring at this level were Lauren and Cathy. Lauren was a frequent inquiry teacher while Cathy was an infrequent inquiry teacher. There did not appear to be a relationship between teaching style and having a preference for the Developer problem-solving style.

Scores that were one or more standard deviations below the mean were considered to indicate a preference for the Explorer problem-solving style. People who prefer the Explorer
problem-solving style produce novel solutions to problems. They think outside of the paradigm, and according to the authors, “readily engage in freewheeling, and piggybacking on the ideas of others (Treffinger, et al., 2007, p. 11).” The authors go on to say that Explorers may find it “difficult to see the value of ideas they consider unexciting or boring (p.11).” Explorers need to be able to take the time to listen to ideas generated by Developers, and to consider their usefulness before leaving the discussion. Explorers tend to generate ideas that seem unrealistic, and they need to realize that some of the ideas may actually be impractical. The teachers with a preference for the Explorer style were Kristin and Simone. The two teachers were placed in the frequent inquiry and infrequent inquiry groups, respectively. There was no evidence that problem-solving style was related to teacher choice of instructional method.

When the two groups were taken separately, frequent inquiry teacher Lauren was the only one in her group to express a preference, which was for the Developer style. Infrequent inquiry teacher Simone indicated a preference for the Explorer style, while infrequent inquiry teacher Cathy preferred the Developer style (see Table 10 for means and standard deviations of the two, separate groups). Even when examined separately, no pattern for a certain problem-solving style preference within the groups was evident.

Manner of Processing Dimension (MP)

The Manner of Processing dimension scores reported in the manual ranged from 8 to 56. The sample mean for this research study was 27. Lower scores indicated a tendency toward the External Manner of Processing style, thus choosing to work with others when first undertaking a complex problem. External processors enjoy sharing their thinking with others, finding it energizing (Treffinger, et al., 2007). They like to get input from other
people and refine their ideas as they proceed. A higher score tended toward the Internal Manner of Processing style, preferring to work alone when beginning a complicated task. Internal processors prefer thinking through a problem first, “looking deeply into ideas, weighing options carefully and thoroughly (Treffinger, et al., 2007, p. 16).” They tend to share their ideas with others after they have thought the solution through. The teachers’ scores in this study ranged from 13 to 46, with a mean sample score of 27. Preferences were scattered between the two groups of teachers. The teachers who preferred the External style were Lauren and Kelly, who came from different groups. Kelly had a stronger tendency than Lauren toward handling information internally when deciding how to solve a problem.

Connie, one of the frequent inquiry-use teachers, strongly preferred the External style. The rest of the teachers indicated a Moderate preference. No specific pattern of Manner of Processing emerged between the two groups. Therefore this dimension could not be used to understand teacher choice of instructional methods.

When they were inspected separately, only one frequent inquiry teacher expressed a preference. Connie indicated a preference for the External style. Of the infrequent inquiry-use teachers, Alex indicated a preference for the External style, while Kelly and Cathy preferred the Internal style. There was no indication of any influence of Manner of Processing over teacher instructional decision-making.

**Ways of Deciding Dimension (WD)**

The range of scores reported in the manual for the Ways of Deciding dimension extended from 8 to 56. The teacher scores in this study ranged from 16 to 41. The samples mean in this study was 32. A lower score indicated a preference for the Person Focus style, and a higher score indicated a preference for the Task Focus style. The individual preferring
the Person Focus style values harmony, positive relationships, and is concerned with the impact of decisions on people (Treffinger, et al., 2007, p.22). Frequent inquiry-use teachers Connie and Pam preferred the Person Focus style, and were inclined to make decisions based on personal or interpersonal needs.

Those who favor the Task style are logical and look for solutions to problems that are objective and sensible. They are concerned with finding the best result, and the effect of the result on people is kept separate from the idea (Treffinger, et al., 2007, p. 23). The Task Focus style teachers were Kelly, Kristin, and Lauren. These teachers came from both groups. Infrequent inquiry-use teachers Alex, Cathy, Linda and Simone were moderates, basing their decisions on the particular set of circumstances rather than according to task or personal concerns. The moderates all came from the infrequent inquiry-use teachers’ group and the Person Focus teachers both came from the frequent inquiry-use teachers’ group. Although the VIEW: An Assessment of Problem-solving Style scores for Ways of Deciding were not extreme, after examining the data overall the researcher concluded that frequent inquiry-use teachers tended to have a stronger preference for the Person Focus, while the infrequent inquiry-use teachers were less likely to have a preference and more likely to score in the Moderate range.

When separating the two groups, the only frequent inquiry teacher to express a preference was Connie, who favored the Person Focus. Alex, one of the infrequent inquiry-use teachers, also preferred the Person Focus. Two other infrequent inquiry-use teachers, Kelly and Linda, preferred the Task Focus. Separately, the infrequent inquiry-use teachers did not score mostly in the Moderate range, because three of the five indicated preferences. Only one frequent inquiry teacher indicated a preference when the two groups were
compared. When the groups were taken separately, the conclusions from the combined
groups could not be substantiated.

Overall, problem-solving style did not appear to be a salient factor in teacher choice
of instructional method, meaning that teachers used their particular styles to enhance their
classroom teaching regardless of being frequent or less frequent users of inquiry methods.

**Triangulation**

The researcher interpreted the data from this qualitative study to answer the research
questions and to identify catalysts and barriers to teacher use of inquiry. Using the results of
the observation notes, the *EQUIP: Electronic Quality of Inquiry Protocol* rubric (Marshall, et
al., 2008), and the *Survey to Identify Teaching Styles (SITS)*, the researcher was able to
confirm each teacher’s status as a frequent or infrequent teacher of inquiry. The rubric
results aligned closely with the observations, and the results of *EQUIP: Electronic Quality of
Inquiry Protocol* (Marshall, et al., 2008) and the interviews were used to place the
participants on a continuum of inquiry in the categories of no inquiry, low inquiry, structured
inquiry, guided inquiry, and open (or full) inquiry, according to the definition formulated by
Lisa Martin-Hansen (2002), which was based on the definition advanced by the NRC (2002).

The participants in this study were asked to conduct a lesson of their choice. They
were not aware that the researcher was specifically looking for elements of inquiry, and they
presented lessons that they thought would exemplify their teaching style. These lessons were
discussed in the interviews as the teachers described their beliefs and styles. At times the
statements made by the teachers in the interviews did not match what was observed. For
example, Alex and Simone spoke about being inquiry teachers, but conducted whole-group,
teacher-centered lessons for the researcher. Their remarks about inquiry revealed a solid
understanding of the theory and manner of implementation, but they shared that they were cautious about utilizing inquiry due to time constraints and mandated testing demands. This revelation provided insight into how the teachers’ practice aligned with their belief systems. Some of the teachers who presented as infrequent inquiry users demonstrated comprehension of inquiry and its benefits to students, but they were aware that they were required to teach a body of content prior to a specific date for state-mandated testing. They said that they used direct instruction for efficiency so that content coverage could be assured.

The interviews were transcribed by a professional transcription service, then verified by the researcher. Next, member-checking was accomplished by returning the transcripts to the individual teachers for confirmation of their accuracy. All of the teachers agreed that the transcripts reflected what they had said. In most cases the interviews confirmed the inquiry status of the teachers distinguished by SITS and the EQUIP: Electronic Quality of Inquiry Protocol (Marshall, et al., 2008) observation rubric, except for Alex and Simone, who understood inquiry but did not use it frequently.

The use of a sample of maximum variance from multiple cases contributed to the credibility of this research study. Multiple methods and multiple data sources allowed for the triangulation of the data (Merriam, 2009). A reflexivity notebook was used to collect the researcher’s thoughts, feelings, and beliefs regarding inquiry teaching to assist in retaining objectivity. An audit with an expert in inquiry to review the codes, themes, and methods also lent credibility to this study (Merriam, 2009). The researcher agreed with the auditor 98% of the time.

The next chapter offers a discussion of the interpretation of the findings, and answers the research questions posed at the beginning of this study. The catalysts and barriers to
teacher implementation of inquiry in their classrooms are the basis for recommendations to increase inquiry use. Chapter 5 presents the conclusions drawn from the data, the implications for education, and suggestions for further research.
CHAPTER FIVE
SUMMARY AND CONCLUSIONS

Summary of the Research Study

The purpose of this qualitative, multi-case study was to investigate and report the catalysts and barriers to teacher use of inquiry methods in the classroom. Constructivism was the major underlying theory that formed the foundation for this study (Bruner, 1977; Dewey, 1910; Vygotsky, 1978). Many of the current changes in education are supported by constructivism; indeed, the new Common Core State Standards (2010) weave inquiry throughout the content areas they address. In the theory of constructivism, students learn socially, and create knowledge through their experiences with the world around them. This leads to a deeper understanding of the nature of the discipline being studied. The theory of constructivism (Bruner, 1977; Dewey, 1910; Vygotsky, 1978) supports inquiry as a method of learning. The importance of this type of learning cannot be understated, especially in a world where 21st Century skills will be necessary (Darling-Hammond, 2007). Because inquiry education teaches many 21st Century Skills, such as student initiative, self-direction, creativity, critical thinking, problem-solving, and communication skills (Brown, 2006), it is vital that US teachers learn how to implement inquiry for the success of American students in a precarious global economic culture (Darling-Hammond, 2007).

To illuminate the reasons why some teachers embrace inquiry while others avoid it, this research study employed several methods of data collection. A purposeful sample of maximum variance consisting of nine teachers, who were identified as either frequent or infrequent users of inquiry, was chosen to participate in this study. The teachers were interviewed, observed, and administered a problem-solving styles instrument. All of the
interviews were transcribed and entered into HyperRESEARCH (Researchware, 2009), a computer program designed to assist the researcher in the development of codes and themes. The observation notes were also added to the computer program to provide additional data for analysis. Through coding and recoding, the data were assigned to mutually exclusive, clearly delineated, heuristic themes. The information gathered was triangulated to verify trustworthiness, and it was analyzed to identify answers to the research questions.

**Research Questions**

The following questions were used to guide this research study:

1. What are teachers’ understandings and beliefs about teaching and inquiry?
2. What are teachers’ perceptions about educational change?
3. What are teachers’ experiences in using inquiry as students themselves, and later in their own classrooms?
4. What are catalysts and barriers to using inquiry methods in the classroom?
5. What are patterns of problem-solving traits among teachers?

This chapter will provide a discussion of the findings in relationship to the research questions. Because the first three questions were closely related, they were discussed as a unit as a means to uncover catalysts and barriers to teachers’ decisions to implement inquiry methods frequently or infrequently. The response to the fourth question enumerated the catalysts and barriers to teacher use of inquiry pedagogy, which was the heart of this study. The fifth question sought to discover if problem-solving style was influential in teachers’ instructional decision-making. To that end, a problem-solving styles instrument was employed to search for common problem-solving traits among the teachers. The results of that instrument are discussed as they pertain to this investigation.
Conclusions for Questions One, Two and Three

The first three questions were chosen to elicit information that would describe the participants as teachers, and provide insight into some of their belief systems. These data were used to identify catalysts and barriers to teacher use of inquiry learning. It was discovered in the analysis that it was helpful for the sake of clarity to divide the themes into two realms: an internal sphere of influence over which the teachers had personal control, and an external sphere of influence, which were controlled by outside factors such as state or district requirements. This distinction was valuable in identifying the recommended changes and whose responsibility it would be to accomplish them. The emergent themes were grouped under the appropriate sphere of influence.

Internal Spheres of Influence

Beliefs about change. The teachers who implemented inquiry frequently believed that change in education was inevitable, but they did not express optimism for the current changes in education. They discussed high-stakes testing and what they believed to be its deleterious effects on students. Although they agreed that student knowledge should be assessed, they opposed the use of a single measure to evaluate the overall performance of each individual. One of the frequent inquiry-use teachers discussed her view that mastery learning was more important than rushing through the curriculum to prepare for high-stakes tests. The frequent inquiry-use teachers felt disenfranchised due to their lack of input into educational changes. The research of Lee & Yin (2011) recommended teacher contributions when changes are being developed so that teachers are able to accept the changes and maintain some ownership in the process.
In comparison, the infrequent inquiry-use teachers were generally open to change, and expressed hopeful, positive views. One teacher felt empowered in change because she had the opportunity to influence curriculum changes as part of a district committee. As a group, these teachers thought that the new common core standards would help teachers to plan and implement curriculum better than they were able at the present time. They discussed changes in their own teaching that would result from the standards rather than changes in student learning.

In a study by Blanchard & Granger (2008), it was found that if teachers think that a certain form of instruction interferes with test preparation, then, they will not employ the methodology. This could be influential on teachers’ decisions to use inquiry methods. Many of the subjects from both groups expressed apprehension about the amount of time it would take to implement inquiry-based lessons, and were concerned that they would run out of time to teach the topics on the high-stakes tests.

**Direct instruction practices.** The teachers who were concerned about covering content and the need to ensure that their students were test-ready tended to use direct instruction more frequently than the teachers who believed that inquiry learning was worth the additional time. Direct instruction was seen as an efficient method to impart large amounts of information to students in a timely manner. Additionally, the teachers who did not implement inquiry often thought that inquiry was unstructured and unguided, and they feared losing control over the class and the learning. This perception caused the infrequent inquiry-use teachers to avoid inquiry methods (Mayer, 2004). All of the teachers understood the necessity for direct instruction and utilized it daily, but the frequent inquiry-use teachers
held strong beliefs that inquiry learning was beneficial to student learning. They shortened other units to make time to implement their inquiry lessons.

**Student engagement.** The students involved in inquiry lessons were observed to be more engaged in their learning overall in this study. They appeared to be enthusiastic and were attentive for longer periods of time than the students receiving traditional, direct instruction. Although the students in the infrequent inquiry-use classrooms did not display the high level of engagement that the students in the other classrooms did, they participated appropriately in the lessons and understood the tasks they were given by the teachers.

**Teacher emotions.** The teachers who implemented inquiry frequently demonstrated knowledge and confidence in their teaching, especially in inquiry implementation. Conversely, the teachers who utilized inquiry infrequently were less confident in their ability to teach through inquiry methods. Most of them did not have a grasp of what inquiry is, and therefore did not have confidence in inquiry implementation. Overall, teacher beliefs had a major influence on whether they chose to implement inquiry in their teaching (Ajzen & Fishbein, 1980; Dweck, 2007; Roehrig & Kruse, 2005).

**Teacher knowledge of instructional practices.** The teachers who implemented inquiry frequently believed that teachers should be lifelong learners to stay abreast of the topics that interested their students. They said that they often spent their own time researching content so they could assist student learning. They were knowledgeable about science and enjoyed science as a content area. These teachers were also knowledgeable about direct instruction and inquiry pedagogy. They discussed appropriate times to use each teaching method. Each teacher using inquiry frequently also had a vision of what inquiry
was and how to implement it in the classroom. Additionally, they had a clear research process in place for their students to follow when conducting investigations.

The infrequent inquiry-use teachers did not stress their own continued learning in the content areas. A couple of the teachers appeared not to enjoy teaching science, although Alex shared that he had extra courses in science and that he wanted to learn how to implement inquiry effectively in science. Generally, the infrequent inquiry-use teachers seemed to have less knowledge than the other group about inquiry and its implementation. Many of them said they could not visualize inquiry lessons, and one teacher said that she would like training on how to incorporate inquiry into her schedule and the curriculum. Based on the researcher’s data, teachers in this group did not appear to implement a fully established research process in their classrooms. Teacher content knowledge appeared to influence teacher self-efficacy in the classroom (Roehrig & Kruse, 2005). This feeling of self-efficacy translated into confidence to teach inquiry in the classroom.

**Teacher knowledge of inquiry practices.** Knowledge about inquiry and a vision of how it was conducted in the classroom were vital to whether a teacher chose to implement it in the classroom. The teachers in the infrequent inquiry-use group stated that they would implement inquiry if they knew how to conduct effective inquiry lessons. Most of them could not visualize inquiry and said that they did not know how to begin. It is imperative that teachers receive the modeling, training, and coaching that they need to support them as they move towards inquiry implementation.

**Teacher pedagogical beliefs.** Ajzen and Fishbein (1980) developed the theory of planned behavior, based on the premise that people will act in accordance with their beliefs. Their theory was borne out in this research study. The teachers in both the frequent and
infrequent inquiry-use groups discussed their beliefs about teaching and about how students learn. They taught their students according to their beliefs, planning their lessons according to how they thought students would learn the material. There is ample evidence that both direct instruction and inquiry methods are sound, valuable teaching strategies (Brown, 2006; Darling-Hammond, 2007; Epstein & Miller, 2011; Kuhn, 2007; Mayer, 2004; National Research Council, 1996, 2000; Rosenshine, 1978, 2008; Rosenshine & Meister, 1995). Both teaching approaches are necessary to ensure student learning. However, the intention of this study was to discover why many teachers rely heavily on direct instruction more than they implement inquiry instruction. For the purposes of this research, the teachers chosen to participate were identified as those who either used inquiry frequently or infrequently.

The frequent inquiry-use teachers differed from the other group in several ways. They expressed more self-assurance in their teaching as evidenced by their comments in the interviews, used teacher mistakes as teachable moments, and modeled inquiry-oriented behavior by researching information in front of their students when they did not know an answer. They believed that hands-on instruction was a tool for inquiry learning, rather than an end in itself. They used inquiry to help differentiate lessons for their students. All of the frequent inquiry-use teachers agreed that direct instruction was crucial to student learning, and they utilized that method to scaffold their students into various stages of inquiry learning in different content areas. However, they held strong beliefs that inquiry methods provide deep, lasting learning for students. This belief system provided a foundation for the frequent inquiry-use teachers to choose inquiry as an instructional practice (Blanchard & Granger, 2008; Byman, et al., 2009; Hogan & Berkowitz, 2000). In fact, having a strong belief in the effectiveness of inquiry was a more important indicator of whether or not teachers would
implement inquiry than any particular teaching style (Ajzen & Fishbein, 1980; Roehrig & Kruse, 2005).

The infrequent inquiry-use teachers discussed their teaching in terms of direct instruction. They shared their concern that the curriculum and state standards might not be taught if they did not directly teach students prior to state testing. Two of the teachers were not clear about what inquiry entailed, but after hearing a short description, one of them expressed interest in learning more, while the other did not think she had time to learn a new strategy at the moment. The two remaining teachers spoke about their interest in inquiry learning, but said they did not implement it as often as they would like.

The infrequent inquiry-user group believed that hands-on lessons were important to student learning. They acknowledged the need to differentiate lessons for their students to meet individual needs. This group of teachers did express concern about not knowing the answers to students’ questions and losing control of the class during inquiry lessons.

**Teacher problem-solving style.** Both groups of teachers maintained a variety of problem-solving preferences, using their problem-solving styles to maximize their teaching. There was no pattern of preferences between the teachers in any particular group. The frequent inquiry-use teachers tended toward a task focus on the Ways of Deciding dimension of *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007), but overall problem-solving style did not appear to influence teachers’ decisions about inquiry teaching.

**Teaching style.** The infrequent inquiry-use teachers described themselves as effective classroom managers, rule-followers, afraid of making mistakes or losing control of the class, enthusiastic, and passionate about their teaching. The frequent inquiry-use teachers used words such as flexible, willing to try new methods, passionate, and unafraid of making
mistakes in front of students. Overall, the teachers who chose to utilize inquiry expressed more confidence in their teaching. There is a possibility that possessing a fixed or growth mindset (Dweck, 2006) may have influenced the teachers when making instructional choices. A fixed mindset could lead to a teacher using direct instruction, which is a familiar stand-by to most teachers. A growth mindset could act as a catalyst to trying unfamiliar methods such as inquiry.

**Types of questions posed.** All of the teachers in this study posed literal and higher order thinking questions. The difference between the two groups was the number of higher order questions asked in the course of the lesson. The frequent inquiry-use teachers asked higher order questions more often than the infrequent inquiry-use teachers. They also allowed their students to pose more questions than the infrequent inquiry-use teachers.

**External Spheres of Influence**

**Age and years of teaching experience.** The results of this small case study revealed that the teachers who implemented inquiry frequently in their classrooms were older and had more experience than the teachers who did not use frequently often. Those implementing inquiry had a mean age of 40 and a mean of 11 years of teaching experience. Those not implementing inquiry frequently had a mean age of 32 and a mean of 6 years of teaching experience. There is literature that indicates that younger teachers in the Enthusiasm and Growth, and Competency stages of their careers were more likely to embrace new ideas than older teachers who may be set in their ways (Hargreaves, 2004; Lee & Yin, 2011; Maskit, 2011). It is unclear whether age and experience truly influence teachers’ decisions to implement inquiry due to the small sample size, and the fact that age and years or experience were not controlled for in this study.
Collaboration. The subject of collaboration was discussed by both groups of teachers. All of the teachers in this study desired time for quality collaborative opportunities. One teacher expressed disappointment with her collaborative time because her grade level team had too many clerical issues, which left little time for discussing student learning. Time to discuss student work and behaviors, collaborate on lessons, and learn from each other was seen as crucial by both groups of teachers. One of the teachers who were part of the frequent inquiry-use group did not have the opportunity to collaborate with her grade level team in her previous position. She described feelings of loneliness as the only inquiry teacher in her school. The teachers all thought that collaboration could provide teacher support when attempting to implement a new strategy such as inquiry. Therefore, as noted by the study participants, collaboration is most likely critical to teachers’ decisions to implement inquiry learning in their classrooms.

Mandated change. Both groups of teachers experienced time constraints, partially due to the number of educational changes being implemented at the time of this study (e.g., curriculum changes to address the new state standards, new evaluation procedures required by the state, and high-stakes testing focused on the new standards). They articulated the need for better program support to assist them with those changes. Both groups also thought that too much change was being proposed at one time, and that it should be implemented more slowly to allow teachers to adjust instruction appropriately. The frequent inquiry-use teachers said that they sometimes experienced peer pressure when implementing inquiry. Inquiry was seen by some of their peers as a time-consuming and impractical instructional method and was criticized as an ineffective, wrong way to teach.
Mandated testing. All of the teachers in this study were concerned about the use of technology for testing. They cited computer problems, the lack of computers to meet testing needs, and glitches that caused student work to be lost. The frequent inquiry-use teachers did not endorse high-stakes testing. They were concerned that it took too much time away from authentic learning, and that it was developmentally inappropriate for their students.

The infrequent inquiry-use teachers did not enjoy allotting time for test preparation, but they thought that testing was necessary. They said that teaching the CCSS, followed by testing students would improve teaching and learning. They were more open to using testing to guide their practice than the frequent inquiry-use teachers were.

Parent feedback. Parent feedback was discussed by some teachers in the frequent inquiry-use group. They noted that the parents were vocal about having their children keep up with other students in the other classes in that grade level. These two teachers said that they utilized inquiry, which often took a lot of class time. They shortened other units to make the time, but parents were not always happy that they seemed to be behind everyone else. This did not deter them from implementing a method they believed in, but they did not want the parents to be unhappy. This discomfort could cause other teachers to stop inquiry implementation.

Peer pressure. Three of the frequent inquiry-use teachers spoke about comments made by some of their colleagues about inquiry teaching. Two of the teachers experienced pressure to keep up with the other grade level classes. One teacher was told by another that inquiry was the wrong way to teach and that she needed to use direct instruction. Although these teachers continued to implement inquiry in their classrooms, they noted that this pressure might affect other teachers and influence their instructional choices.
**Professional development.** Professional development was a need cited by both groups of teachers. The infrequent inquiry-use teachers expressed a need for modeling and coaching to help them understand inquiry pedagogy because it was difficult to envision inquiry learning in the classroom. All of the infrequent inquiry-use teachers thought that professional development should be on-going, focused, and more practical rather than theoretical. They discussed the desire for modeling by a coach, assistance in the planning of inquiry lessons, and constructive feedback on their teaching.

The frequent inquiry-use teachers also suggested focused professional development as a way to assist teachers in inquiry implementation. These teachers thought it would benefit teachers new to the method, but they also expressed openness to additional training themselves. With the current spotlight on 21st Century Skills, professional development appears to be a key to establishing inquiry learning as a more universal practice. The need for better preparation for pre-service teachers in general instructional methodologies and, particularly science instruction, has been prescribed by Choi & Ramsey (2009), based upon their findings that teachers who had experience learning through inquiry methods were more likely to implement it.

**Program support.** Two factors under program support emerged that appeared to influence teacher use of inquiry. The first was the lack of appropriate materials to use in inquiry lessons. Some of the frequent inquiry-use teachers noted that when they helped other teachers start using inquiry, they gathered materials for them to make the task easier. They suggested maintaining a cache of materials for the content areas so that teachers could access them readily. The teachers in both groups also thought that there was a need for more materials at their students’ reading levels.
The second important factor that emerged was that most teachers would be more comfortable with inquiry if they had help in the classroom. They discussed the need for paraprofessional support, parent volunteers, and content area specialists to support their efforts in inquiry implementation. Despite the lack of assistance in the classroom, the frequent-inquiry teachers planned and taught inquiry lessons.

**State standards.** The infrequent inquiry-use teachers were more open to the new state standards than the frequent inquiry-use teachers. They were hopeful that the standards would improve teaching and learning. However, they did not think that the standards could be taught through inquiry.

The frequent inquiry-use teachers were not as open to the state standards, with one exception. One of the frequent inquiry-use teachers already designed her lessons with the standards in mind. She had support from the inquiry cohort to which she belonged. She said that the members of the cohort were required to plan inquiry lessons, and to provide the standards the lessons addressed. Because the standards are required, teachers will have to learn how to use them as the basis for inquiry lessons.

**Teacher experience with inquiry as students.** Most of the teachers who implemented inquiry learning frequently had experiences learning through inquiry methods in high school or college when they were students in school. Several of the frequent inquiry-use teachers discussed their frustration learning through this method, but said that in the end, they felt they had learned more because of their engagement in the process, and had a model to follow for their own classrooms. Pam, who had no previous experience with inquiry, learned to implement it by co-teaching with Connie, who knew how to apply inquiry in the classroom.
Two of the infrequent inquiry-use teachers had never had any experience with inquiry when they were in school, and could not define or describe inquiry learning. Another infrequent inquiry teacher remembered vague experiences in college with finding answers to questions, but could not clearly remember the process. The fourth infrequent inquiry teacher plainly remembered learning through inquiry methods as a student in college, and could define and describe inquiry as pedagogy. He had also taken extra science and mathematics courses, and had expressed interest in implementing inquiry methods more frequently in the future. The literature supports the need for teachers to experience inquiry to provide a model and framework for implementation (Blanchard & Granger, 2008).

**Time constraints.** The lack of time was a concern for both groups of teachers. They all experienced curriculum overload, lack of time to plan and prepare lessons, and lack of time to reflect on practice. Some teachers noted that teaching had become so time-consuming that it impacted their personal lives with their families. This lack of time led the infrequent inquiry-use teachers to question the efficacy of inquiry in the classroom. They described the efficiency of direct instruction for teaching large amounts of content, and for test preparation. In this study, time constraints influenced teacher instructional decision-making.

**Conclusions for Questions Four and Five**

This section of the chapter provides an interpretive discussion of the catalysts and barriers to teacher use of inquiry, which were at the heart of this investigation. As a result of the analysis, viable answers to research question four were found. Question four asked, what are the catalysts and barriers to teacher use of inquiry? Potential solutions to this question lie in the catalysts and barriers revealed in this study. This discussion is organized around the
question clusters that were posed to the subjects rather than by themes, which were discussed previously. These factors are related to the internal and external spheres of influence as evidenced by the data that were collected. Next, question five is answered by interpreting the results of the problem-solving styles instrument, *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007) as it related to catalysts and barriers to teacher use of inquiry.

**Question 4: Catalysts and Barriers under the Internal Sphere of Influence**

**Beliefs about educational change.** The teachers participating in this study had a variety of opinions and feelings about change. The frequent inquiry-use teachers believed that change in education was inevitable, but they were wary of its effects on education and students. They were concerned about high-stakes testing and whether the tests would have a positive influence on teaching and learning. Changes in their teaching styles to include inquiry use sometimes elicited peer pressure from their colleagues. The infrequent inquiry-use teachers were generally open to and positive about educational change. These teachers used direct instruction to teach their students, which is a widely accepted and well-understood method of teaching. They did not experience peer pressure. The use of inquiry, a less widely understood instructional practice, caused discomfort for some of the frequent inquiry-use teachers due to comments from colleagues who did not understand the inquiry process. Both groups of teachers acknowledged that they experienced stress and pressure due to time constraints exacerbated by the number of state-mandated educational changes that took place at the time of this study. A teacher’s beliefs acted as both catalysts and barriers to teacher use of inquiry, depending on the person’s point of view. This is supported by Ajzen and Fishbein’s theory of planned behavior (1980), in which actions are based upon the personal beliefs of the individual.
**Teacher emotions.** Teacher confidence played a role in developing a teaching style that lent itself to implementing inquiry education in the classroom. The frequent inquiry-use teachers exhibited confidence in their inquiry teaching. The infrequent inquiry-use teachers expressed confidence in direct teaching methods, but indicated less confidence in teaching with inquiry. In this study, confidence and knowledge of inquiry practices both acted as a catalyst to teacher use of inquiry. Teachers who lacked confidence and knowledge about inquiry learning experienced this as a barrier to their willingness to implement inquiry.

**Teacher knowledge of instructional practices.** Several catalysts to teacher use of inquiry were grouped under this theme. Teachers who believe in life-long learning, particularly about the content their students are studying, are likely to implement inquiry practices. Also, the teachers in this study who were frequent users of inquiry enjoyed science as a content area and topic of personal interest. They used their knowledge about science to implement a clear research process in their classrooms. They were knowledgeable about inquiry, and had the ability to visualize it in action in the classroom. One frequent inquiry-use teacher utilized inquiry practices to teach writing, and another implemented inquiry in social studies. This illustrates that inquiry does not have to be limited to science, even though science is the content area most often studied when researchers investigate inquiry practices.

The barriers in this section were a paucity of teacher knowledge and interest in science and inquiry implementation, lack of a clear research process in the classroom, the teachers’ opportunity for expanding content knowledge, and the lack of a model to follow to allow for teacher visualization of inquiry in the classroom. Many teachers felt overwhelmed with new learning due to changes in district policies or curricula, and were not ready to learn
an additional teaching method. Teachers’ personal lives also prevented some of them from spending time in continued learning.

**Teaching style and personal beliefs.** Emerging catalysts to teacher use of inquiry were strong teacher belief in the benefits of inquiry for student learning, the ability of the teacher to use mistakes or lack of personal knowledge as teachable moments, and the knowledge that inquiry is more than hands-on activities alone. These attributes appeared to be attainable through teacher experience and training in the inquiry process. There is evidence in the literature that teachers teach according to their own beliefs based on what they have learned and experienced themselves (Blanchard & Granger, 2008; Byman, et al., 2009; Hogan & Berkowitz, 2000). Therefore, it is incumbent upon teacher preparation programs to provide these experiences and understandings to better prepare teachers to use this highly effective teaching pedagogy. This ability would allow teachers to provide their students with a rich, deep learning experience that will prepare them for the 21st Century world in which they must compete (Brown, 2006; Darling-Hammond, 2007).

The barriers to teacher use of inquiry included the fear of making mistakes and not knowing the answers in front of students, the teacher’s worry about wasting time off-topic, and the need to maintain control of the class. It is interesting to recognize that these barriers can be addressed by systematically supporting the catalysts identified in the section above. If teachers clearly understand what inquiry is and how to implement it, they may realize that turning lack of knowledge into teachable moments on how to conduct research to answer one’s questions is a valuable use of class time. If the teacher spends time instructing and guiding students through the inquiry process, they will not lose control of the class. Rather, they will give control over learning to the students, who will need to be able to pose
questions and discover answers to their questions independently as adults (Alfieri, et al., 2011; Anderson, 2001; Hmelo-Silver, 2007; Kuhn, 2007).

**External Sphere of Influence: Catalysts and Barriers**

**Age and experience.** The teachers in this study who used inquiry frequently in their classrooms had a mean age of 40, and their mean number of years teaching was 11. The teachers who did not use inquiry frequently had a mean age of 32, and their mean number of years teaching was 6. In this study, with a small sample of nine, being older with many years of experience was a catalyst to teacher use of inquiry.

**Collaboration.** Time for quality collaboration is a crucial catalyst for supporting teachers in learning about inquiry instruction (Darling-Hammond, 2007; Duran, et al., 2009). Both groups of teachers discussed their appreciation and need for collaboration as they continued to improve their teaching skills. One teacher related that clerical duties should be managed outside of collaboration time, if at all possible. All of the teachers were eager to use their collaborative time to discuss teaching methods, students, and the challenges they faced with other team members. The frequent inquiry-use teachers shared that they used some of their collaborative time to help other teachers who wanted to learn how to implement inquiry in their classrooms. Collaboration would be extremely valuable as a support for teachers who are learning to implement inquiry, and also to teachers who already employ inquiry methods in the classroom.

**Mandated educational change.** All of the teachers held strong opinions about educational change. The two groups viewed change differently. The frequent inquiry-use teachers were wary of mandated change, and they were uncomfortable with the use of a single test as a measure of student learning. The infrequent inquiry-use teachers were
positive and open to change. None of the teachers said that educational change caused them to alter their instructional practices. The fact of educational change did not appear to influence teacher instructional choice, although teacher feelings about change did.

**Professional development.** One of the most difficult barriers appeared to be the lack of a model to follow for teachers who were inexperienced with inquiry practices. If teachers lack knowledge about inquiry and its implementation, they may not be open to trying it (Makar, 2007). Appropriate professional development opportunities are also crucial to increasing the implementation of inquiry learning in the classroom (Twigg, 2010). Teachers expressed the need for a model to follow, which suggests that an inquiry coach could be quite helpful. An inquiry coach could model lessons, observe the teachers in a non-judgmental manner, and provide valuable feedback. An inquiry coach could also help less experienced teachers to plan lessons and gather materials, while helping more experienced teachers to increase their knowledge about the inquiry method. Therefore, focused, practical, on-going professional development is a catalyst to helping teachers to implement inquiry in their classrooms.

**Teacher experience with inquiry as a student.** This study seems to support the idea that learning through inquiry methods fosters teachers’ willingness to implement inquiry methods in their own classrooms (Blanchard & Granger, 2008). Most of the frequent inquiry-use teachers could recall inquiry learning experiences from their own student lives. They remembered their excitement at being a part of the process and discovering information to answer their own questions, and they implemented inquiry strategies in their own classrooms to engage students and enhance learning. Their experiences as students also
provided a model for implementation, and made it possible for the frequent inquiry-use teachers to envision inquiry learning in the classroom.

Three of the infrequent inquiry-use teachers either had no memory or a vague recollection of learning through inquiry methods in high school or college. They had not personally experienced the benefits of inquiry learning, such as learning to frame problems, design investigations, or search for information to answer research questions. Also, they did not employ a clear research process in their classrooms, perhaps due to the fact that they lacked a model to follow. Without a model, it may have been difficult to understand how to implement inquiry education. Perhaps with training and coaching, these teachers would be able to understand and envision inquiry methods in the classroom. One infrequent inquiry teacher, who had described his experiences learning through inquiry when he was in school, expressed a desire to implement inquiry more frequently in the future.

**Question 5: What are Patterns of Problem-solving Traits among Teachers?**

Problem-solving preferences were investigated in this study to reveal whether these inclinations had an effect on teacher choice of instructional methods. Problem-solving is an important element in inquiry education (National Research Council, 1996, 2000), and it was postulated that problem-solving style might have an influence on whether teachers chose to implement inquiry learning. *VIEW: An Assessment of Problem-solving Style* (Treffinger, et al., 2007) was the problem-solving styles instrument chosen to explore this concept.

Connie, Kelly, Alex, and Linda were considered to score moderately on Orientation to Change (OC) dimension. Connie and Kelly were part of the frequent inquiry-use teachers’ group, but Alex and Linda were infrequent inquiry-use teachers, signifying that there may
not be a link between having a Moderate style preference and deciding to implement inquiry lessons.

The teachers scoring in the Developer range on OC were Lauren and Cathy. Lauren was a frequent inquiry-use teacher while Cathy was an infrequent inquiry-use teacher. There did not appear to be a relationship between teaching style and having a preference for the Developer problem-solving style.

The teachers with a preference for the Explorer style on OC were Kristin and Simone. The two teachers were placed in the frequent inquiry and infrequent inquiry groups, respectively. There was no evidence that problem-solving style was related to teacher choice of instructional method.

When the two groups were taken separately, frequent inquiry teacher Lauren was the only one in her group to express a preference, which was for the Developer style. Infrequent inquiry teacher Simone indicated a preference for the Explorer style, while infrequent inquiry teacher Cathy preferred the Developer style (see Table 10 for means and standard deviations for the two groups). Even when examined separately, no pattern for a certain problem-solving style preference within or between the groups was evident. Manner of Processing did not yield any patterns among the teachers. Although VIEW: An Assessment of Problem-solving Style scores for Ways of Deciding were not extreme, after examining the data overall the researcher concluded that frequent inquiry-use teachers tended to have a stronger preference for the Person Focus, while the infrequent inquiry-use teachers were less likely to have a preference and more likely to score in the Moderate range.

The findings from the problem-solving style instrument, VIEW: An Assessment of Problem-solving Style (Treffinger, et al., 2007) did not uncover any particular common traits
among either group of teachers, but both groups used their problem-solving style preferences to enhance their work in the classroom. Because this was a very small study, there may not have been enough subjects to reveal common problem-solving traits. Perhaps a large study would provide more insight into this area, or perhaps there is no connection between preferred problem-solving style and instructional practice. A large sample would provide more valid results in this domain.

**Implications for Education and Instructional Leaders**

Several studies have supported the results of this current investigation in which frequent inquiry-use teachers that experienced inquiry learning as students were likely to use that instructional method in their classrooms. Student teachers that did not learn through inquiry methods in their college courses demonstrated less understanding of the concept than student teachers that were exposed to inquiry methodologies (Spang, 2008; Syer, 2007). The student teachers that were knowledgeable about inquiry were likely to try it during their student teacher experiences (Syer, 2007), and those that learned through inquiry experiences demonstrated more aspects of inquiry practice in their own classrooms than teachers who did not have that opportunity (Spang, 2008). One implication that can be drawn from the results of this study is that universities and colleges should include the study and practice of inquiry methods in teacher training programs. The catalysts for teachers who employed inquiry methods in this research study included having a strong belief in the effectiveness of inquiry, a clear understanding of inquiry learning, and a vision for its implementation. These beliefs and understandings were a result of the teachers having learned through inquiry methods in college courses. The courses taught through inquiry provided a model for the teachers to follow in their own classrooms. The frequent inquiry-use teachers also gained a working
knowledge of the research process and were able to describe how their students were expected to conduct investigations. Methods classes for pre-service teachers should include training in the implementation of inquiry to provide schema and a vision for future use.

As a group, the frequent inquiry-use teachers had more courses, and more interest, in science and mathematics than the teachers who used inquiry methods infrequently. Higher education should require science and mathematics courses that utilize inquiry instruction to supply future teachers with the vision and experience to implement inquiry in their own classrooms. Inquiry methods are most commonly used in science, making this a significant content area for inquiry training. Universities should also teach pre-service teachers how to implement inquiry in non-traditional areas such as reading, writing, and social studies. Kelly and Lauren, both frequent inquiry users, successfully implemented inquiry in writing and social studies. In the event that higher education begins to focus on these recommendations, beginning teacher confidence in inquiry use may increase, which may result in teachers’ openness to conduct inquiry-based lessons early on in their careers.

Adequate time for quality collaboration during the school day is vital to providing the support teachers need to implement inquiry. One way to support these efforts would be to include and schedule collaboration time into all teachers’ schedules. The teachers who are more knowledgeable about inquiry could supply practical and moral support to novice inquiry teachers, and all teachers would have the opportunity to trouble-shoot problems and share ideas.

Local school districts also bear a responsibility to ensure that their teachers are highly trained and able to utilize a variety of instructional practices, including inquiry. Although there is inquiry training available, many districts do not provide it as evidenced by the
statements made by the teachers in this research investigation. Supportive, on-going professional development in inquiry methods is crucial to the success of implementation of an unfamiliar strategy. Teachers need to know the pragmatic details about how to plan and prepare for inquiry lessons, and how to conduct inquiry investigations with their students. Teachers who do not understand inquiry pedagogy could benefit from coaching and models.

Additionally, schools must support inquiry learning by providing appropriate materials for teachers. Many of the teachers in this study decried the lack of leveled texts that matched their students’ reading abilities. They also discussed the need for a cache of content-related materials that could be shared by grade level teachers, which would reduce preparation time for inquiry-based lessons. Because the lack of time was a factor in some teachers’ decisions whether to implement inquiry, having a source of ready-to-use materials for each inquiry unit would remove one barrier from inquiry implementation.

The teachers in this study all expressed the need for extra help in the classroom to assist in inquiry implementation. Whether that support is in the form of a paraprofessional, co-teacher, collaboration with specialists, or even parent volunteers, it appears that the addition of another adult to aid teachers would be very beneficial to student learning. Most of the teachers acknowledged the benefits of inquiry learning for students, but they were fearful that they could lose control of learning and the class. It seems that additional classroom assistance, especially as teachers learn to implement inquiry, would help to alleviate some of the teachers’ fears and concerns.

Limitations

The findings of this study are attributable to a small sample of participants. A larger study might reveal other influences on teachers’ willingness to implement inquiry learning.
A teaching methods survey containing more than 16 questions might have improved the researcher’s chances of identifying frequent inquiry-use teachers. Because the subjects in this research study were from demographically similar schools, the results of this study cannot be generalized to any other population, except perhaps at the discretion of a researcher studying a similar group (Merriam, 2009). As human instruments, the subjects were interviewed with the expectation of honesty in their answers. There is no method to check for honesty; therefore there is always the possibility that the subjects’ answers to the interview questions may not be entirely accurate. Also, the researcher cannot be certain that all of the teachers did not know the purpose of this study, which may have influenced some teachers’ choice of instructional methods for the observed lesson.

Researchers bias is another limitation to any qualitative study. A reflexive journal was kept to identify bias and to reach epoche, the state of refraining from judgment (Merriam, 2009). The journal was used several times to recalibrate the researcher’s perspective to prevent bias in the analysis and reporting of data.

This study does not claim to identify an exhaustive list of influences on teacher use of inquiry pedagogy. However, it has enumerated some of the most salient influences as described by teachers who do and do not employ inquiry learning.

Suggestions for Future Research

Based upon the findings of this research study, it is suggested that a study be conducted on teachers of a variety of ages and years of teaching experience and inquiry use. Perhaps if these variables were controlled, new insights into the influence of age and stage of career could be identified. Perhaps a large study would render more generalizable results.
There is literature that supports the idea that age and experience teaching may be related to teacher behavior and instructional choice (Hargreaves, 2004).

It would be interesting to learn whether the teachers possessed a fixed or growth mindset (Dweck, 2006). Perhaps research in this area could enlighten the education community about whether a fixed mindset stands to prevent a teacher from implementing inquiry. Because Dweck found that mindset can be altered, perhaps professional development to teach the growth mindset would assist teachers to increase their confidence and employ inquiry as part of their teaching repertoire.

Another area for further research is to study the design of professional development and mentoring programs to determine if teachers would benefit more from on-going coaching and training that from shorter periods of learning. The teachers in this study thought that inquiry was difficult to visualize, and that it would require extensive training to understand how it could be utilized to enrich student learning. The literature suggests that teacher participation in an iterative process would provide more practice and develop more lasting skills than short, one-shot professional development (Duran, Ballone-Duran, Haney, & Beltyukova, 2009).

Further research using a larger sample might reveal a connection between problem-solving style and teacher choice of instructional practices. This study was small, making it difficult to detect common patterns and traits among the teachers. As an alternative, a general personality test might be useful in predicting teachers who might be more open than others to inquiry implementation. Common personality traits among frequent and infrequent inquiry-use teachers could exist. If so, it may be possible to use personality measures to
identify teachers who may be likely to choose to implement inquiry instruction, and to help teachers who might experience trepidation.

Another area for further study is the role in teachers’ overall confidence in the decision to implement inquiry. Of course teachers with inquiry experience feel confident in its use, but in this study the teachers who did not display overall confidence in their teaching were reluctant to attempt inquiry lessons without special training and guidance. Some of these teachers were new to the profession and may not have the experience to feel confident yet. It might shed some light on teacher use of inquiry to try to determine the relationship between teacher confidence and inquiry use.

**Conclusion**

Many factors influence instructional decisions made by teachers on a daily basis. Those who tend to implement inquiry learning frequently exhibited confidence in their teaching no matter what the method. Most of them had experienced inquiry learning when they were students, which provided them with a model to follow and an understanding of inquiry methods for student learning. They held strong beliefs that inquiry learning was an important teaching technique along with other strategies they employed, such as direct instruction. The frequent inquiry-use teachers enjoyed and possessed knowledge of science and mathematics, which are the traditional subjects taught through the inquiry method. They had also developed a research process for their students to follow.

In contrast, the infrequent inquiry-use teachers did not have a clear understanding of inquiry learning and its benefits to student learning. Most of them did not employ a clear research process in their classrooms. They were less confident overall than the frequent inquiry-use teachers, but they expressed positive, hopeful attitudes about educational change.
Several of them expressed the desire to learn more about inquiry education, and believed that the best way to learn more would be through practical, on-going professional development.

Both groups of teachers valued collaboration between their team members and paraprofessionals for support and to provide a clear direction. Professional development was the factor most often emphasized by teachers in both groups. Specifically, the teachers wanted on-going, focused, practical help to learn how to implement inquiry methods in the classroom. Several teachers mentioned wanting a coach to model for them, and to help them plan lessons and gather materials.

Inquiry-based teaching is now a necessary method in student preparation for the world of tomorrow. It provides many benefits such as critical thinking opportunities, the ability to pose and answer questions, the ability to design plans to answer those questions, and collaboration. These skills will be vital to the success of individuals and to the nation. The US is falling further and further behind in educational achievement. Unless students are taught to be creative, think critically, work collaboratively with others, and clearly communicate, the US economy will not keep up with the rest of the world (Darling-Hammond, 2007). The strength and vitality of the nation depends upon the ability of its citizens to problem-find, problem-solve, and work together to institute a strong, competitive economy (Shore, B.M., Birlean, C., Walker, C.L., Ritchie, K.C., LaBanca, F., & Aulls, M.W. 2009). Universities have a responsibility to support these skills by making inquiry a universal part of their curricula to enable new teachers to enter the field with the skills to educate the workers of tomorrow. Appropriate, practical professional development opportunities would help teachers already in the field to gain the confidence, knowledge, and support to implement inquiry education for the benefit of their students.
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Appendix A: Alignment between Inquiry and 21st Century Skills
## Alignment between Inquiry and 21st Century Skills

<table>
<thead>
<tr>
<th>Inquiry</th>
<th>21st Century Skills</th>
</tr>
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<tbody>
<tr>
<td>Student-centered</td>
<td>Initiative and self-direction, leadership and responsibility</td>
</tr>
<tr>
<td>Problem-finding</td>
<td>Innovation</td>
</tr>
<tr>
<td>Creative problem-solving</td>
<td>Creativity and problem-solving</td>
</tr>
<tr>
<td>Real-life problems</td>
<td>Global awareness, critical thinking</td>
</tr>
<tr>
<td>Communication of results</td>
<td>Communication skills</td>
</tr>
<tr>
<td>Collaboration with other students and mentors, such as teachers</td>
<td>Collaboration, communication skills, productivity, accountability</td>
</tr>
<tr>
<td>Higher-order thinking skills</td>
<td>Critical thinking</td>
</tr>
<tr>
<td>Deep understanding of concepts</td>
<td>Understanding of core curriculum at high levels</td>
</tr>
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</table>

(Brown, 2006; NRC, 2000)
Appendix B: *Survey to Identify Teaching Styles (SITS)*
Survey to Identify Teaching Styles

To complete the survey, please circle the number that best matches how you use each teaching method, \(4 = \) Very Often, \(3 = \) Often, \(2 = \) Sometimes, \(1 = \) Rarely.

1. I primarily use guided reading groups to teach reading.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

2. I guide cooperative learning groups and provide feedback to focus learning.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

3. I allow students to choose how to learn information (e.g., research, use of books or technology).
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

4. I use explicit teaching and mini-lessons to ensure that students learn new concepts.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

5. I use discovery learning with my students.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

6. To make my thinking concrete, I use think-alouds and modeling while reading to the class so students comprehend text.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

7. I use lecture-discussion to deliver content-specific information.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

8. My students have discussions and conversations about open-ended questions that don’t have correct answers.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

9. I use inquiry instruction, allowing students to pose their own questions and do research to pursue potential answers.
   - Very Often: 4
   - Often: 3
   - Sometimes: 2
   - Rarely: 1

10. I use problem-based learning, asking students to figure out a problem and report
novel solutions.

<table>
<thead>
<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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<tr>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
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11. I demonstrate and model how to answer questions to scaffold learning.

<table>
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<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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<tr>
<td>4</td>
<td>3</td>
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12. I provide systematic corrections and feedback to support my students in finding the correct answer.

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<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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<tr>
<td>4</td>
<td>3</td>
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</tbody>
</table>

13. I use/would use explorational web-quests (available on-line activities that help students explore story settings and the real history behind them. For example, *Stone Fox* takes place in Wyoming, so students are given choices about what they would like to learn about that state) to extend my students’ understanding of what they have read.

<table>
<thead>
<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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<tbody>
<tr>
<td>4</td>
<td>3</td>
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</table>

14. I use shared reading/writing with my students so we can co-construct responses to text comprehension.

<table>
<thead>
<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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<tbody>
<tr>
<td>4</td>
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</table>

15. I ask my students to design and conduct their own investigations.

<table>
<thead>
<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
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</table>

16. I use independent study to give students the opportunity to investigate topics of interest to them.

<table>
<thead>
<tr>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
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<tbody>
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</table>
Appendix C: Interview Questions
Interview Questions

Teaching Style and Personal Beliefs

1. Describe yourself as a teacher. How would you describe your teaching style?
2. Tell me more about your teaching style. How did it develop over time?
3. In a perfect world, how would you change your teaching style, if at all?
4. What do you think is the ideal way for children to learn?
5. What has been the biggest influence on your teaching style? Why?
6. What percentage of the time is spent in teacher-directed instruction? In student-directed activities? Why? How does this affect learning?
7. Can you explain the research process you use in your classroom?
8. What kinds of products do your students produce to demonstrate their learning? (Projects, test scores, papers, etc.) How is it decided which products to create?
9. How do you use collaboration with others as a teacher? What impact does it have on student learning?

Teacher Self-perception

10. Describe yourself as a learner.
11. What are your favorite things to teach? Why?
12. What don’t you like to teach? Why?
13. Describe a time when you felt successful as a teacher.
14. Describe a time when you felt challenged as a teacher.
15. Describe a difficult problem that you have solved.
16. Describe a difficult problem you have solved in the classroom.
Teacher Problem-solving Style and Perception of Educational Change

Orientation to Change

17. Discuss your experience with change in the daily life of teaching.

18. Can you describe a situation in your school in which change was required of you? Did you have any input? How do you feel about authority and change in the classroom?

19. Can you discuss a time when you have initiated change in your classroom, school, or district?

20. What are your thoughts about how change is implemented in your school? In your district?

21. What makes educational change easier (or more difficult) for you to adjust to?

Manner of Processing

22. Do you feel more comfortable planning for instructional change on your own, or do you prefer to discuss it and think it through with others?

23. Is it more energizing for you to process what change means and how to respond to it with others, or by yourself?

Ways of Deciding

24. How do you decide what to do when faced with instructional change?

25. Is it more important to follow through with instructional change the way the district asks you to, or do you think it’s more important to look at change and how it affects the students? How do you decide, or do you accommodate each? If you accommodate, how do you accomplish that?
Knowledge and Perceptions about Inquiry

26. How would you describe inquiry?

27. What is your definition of inquiry? How do you use inquiry skills in your life?

28. How is inquiry used in the classroom?

Teacher Experience with Inquiry

29. How do you use inquiry skills in the classroom?

30. Based on your experience, what are positive aspects of implementing inquiry instruction?

31. Based on your experience, what can prevent a teacher from using inquiry instruction? When has this happened to you?

32. What would make it easier for teachers to experiment with inquiry in the classroom?

33. As a student, did you ever experience inquiry learning? If so, how did it affect your learning?

34. How did your experiences as a student influence your current teaching style?

Catalysts and Barriers to Teacher use of Inquiry

35. In your opinion, what are the catalysts and barriers to teacher use of inquiry methods in the classroom?
Appendix D: Electronic Quality of Inquiry Protocol (EQUIP; Marshall, Horton, Smart, & Llewellyn, 2009) and Permission Statement from the Author
Dear Dr. Marshall,

I am a doctoral candidate finishing my dissertation on the catalysts and barriers to teacher use of inquiry at Western CT State University. I used your EQUIP rubric during my observations to determine the level of inquiry in my subjects' lessons. It fit exactly what I needed to learn, and was fairly easy to use.

I was wondering if I could please have a statement of permission to include a copy in my appendices so that my committee can see it. I would be most grateful; without this statement I will not be able to include EQUIP, and I think it is an excellent instrument that others might like to use in the future.

Thank you for your kind attention. I look forward to hearing from you.

Sincerely,
Susan H. Guertin

You may use the EQUIP in your thesis appendix as long as it is cited properly and full credit is given to the authors of the work. See the www.clemson.edu/iim website for more information.

Jeff

Jeff C. Marshall, PhD
Director, Inquiry in Motion Institute
Associate Professor, Science Education, Clemson University
404-A Tillman Hall, Clemson, SC 29634-0705
Phone: 864.656.2059 Fax: 864.656.1322
www.clemson.edu/iim
### II. Time Usage Analysis

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity Codes</th>
<th>Organization Codes</th>
<th>Student Attention to Lesson Codes</th>
<th>Cognitive Codes</th>
<th>Inquiry Instruction Component Codes</th>
<th>Assessment Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
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</table>

Activity Codes—facilitated by teacher
0. Non-instructional time—administrative tasks, handing back/collecting papers, general announcements, time away from instruction.
1. Pre-inquiry—teacher-centered, passive students, prescriptive, didactic discourse pattern, no inquiry attempted.
2. Developing inquiry—teacher-centered with some active engagement of students, prescriptive through not entirely; mostly didactic with some open-ended discussions; teacher dominates; the explain, teacher sees in both group of knowledge and as a facilitator, beginning of class warm-ups.
3. Proficient inquiry—largely student-centered, focus on students as active learners, inquiries are guided and include student input, discourse includes discussions that emphasize process as much as product; teacher facilitates learning and student active in all stages, including the explain phase.
4. Exemplary inquiry—student-centered, students active in constructing understanding of content, rich teacher-student and student-student dialogues, teacher facilitates learning in effective ways to encourage students learning and conceptual development, assumptions and misconceptions are challenged by students and teacher.

Organizational Codes—led by teacher
W Whole class
S Small group
I Individual work

Student Attention to Lesson Code—displayed by students
A Low attention, 30% or fewer students attending to the lesson. Most students are off-task—heads on desks, staring out of the window, chatting with neighbors, etc.
B Medium attention, between 30-50% of students are attending to the lesson.
H High attention, 80% or more of the students are attending to the lesson. Most students are taking notes or looking at the teacher during lecture, writing on the worksheet, most students are volunteering ideas during a discussion, most students are engaged in small group discussions even without the presence of the teacher.

Cognitive Code—displayed by students
0. Other—e.g. classroom disruption, non-instructional portion of lesson, administrative activity.
1. Recall or recognition (e.g., remember, understand) and/or processing focused on completion exercises, computation.
2. Analysis and evaluation (e.g., analyze, justify, interpret).
3. Create (e.g., combine, construct, develop, formulate).

Inquiry Instructional Component Code—facilitated by teacher
0. Non-inquiry: activities with the purpose of skill automation; note memorization of facts; drill and practice; checking answers on homework, quizzes, or classwork with little or no explanation.
1. Engage: typically situated at the beginning of the lesson; assessing student prior knowledge and misconceptions; stimulating student interest.
2. Explore: students investigate a new idea or concept.
3. Explain: teacher or students making sense of an idea or concept.

Extant: [Extend is important but not coded as such because it typically in a new Engage, Explore, or Explain]

Assessment Code—facilitated by teacher
0. No assessment observed.
1. Monitoring (circulating around the room, probing for understanding, checking student progress, commenting as appropriate).
2. Formative assessment (assessing student progress, instruction modified to align with student ability) or Diagnostic assessment (checking for prior knowledge, misconceptions, abilities).

### III. Lesson Descriptive Details

<table>
<thead>
<tr>
<th>Time (minutes into class)</th>
<th>Classroom Notes of Observation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
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<thead>
<tr>
<th>IV: Instructional Factors</th>
<th>Pre-Inquiry (Level 1)</th>
<th>Developing Inquiry (2)</th>
<th>Proficient Inquiry (3)</th>
<th>Exemplary Inquiry (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. <strong>Instructional Strategies</strong></td>
<td>Teacher predominantly lectured to cover content.</td>
<td>Teacher frequently lectured and/or used demonstrations to explain content. Activities were verification only.</td>
<td>Teacher occasionally lectured, but students were engaged in activities that helped develop conceptual understanding.</td>
<td>Teacher occasionally lectured, but students were engaged in investigations that promoted strong conceptual understanding.</td>
</tr>
<tr>
<td>12. <strong>Order of Instruction</strong></td>
<td>Teacher explained concepts; students either did not explore concepts or did so only after explanation.</td>
<td>Teacher asked students to explore concepts before receiving explanation. Teacher explained.</td>
<td>Teacher asked students to explore before explanation. Teacher and students explained.</td>
<td>Teacher asked students to explore concepts before explanation occurred. Though perhaps prompted by the teacher, students provided the explanation.</td>
</tr>
<tr>
<td>13. <strong>Teacher Role</strong></td>
<td>Teacher was center of lesson; rarely acted as facilitator.</td>
<td>Teacher was center of lesson; occasionally acted as facilitator.</td>
<td>Teacher frequently acted as facilitator.</td>
<td>Teacher consistently and effectively acted as a facilitator.</td>
</tr>
<tr>
<td>14. <strong>Student Role</strong></td>
<td>Students were consistently passive as learners (taking notes, practicing on their own).</td>
<td>Students were active to a small extent as learners (highly engaged for very brief moments or to a small extent throughout lesson).</td>
<td>Students were active as learners (involved in discussions, investigations, or activities, but not consistently and clearly focused).</td>
<td>Students were consistently and effectively active as learners (highly engaged at multiple points during lesson and clearly focused on the task).</td>
</tr>
<tr>
<td>15. <strong>Knowledge Acquisition</strong></td>
<td>Student learning focused solely on mastery of facts, information, and/or rote processes.</td>
<td>Student learning focused on mastery of facts and process skills without much focus on understanding of content.</td>
<td>Student learning required application of concepts and process skills in new situations.</td>
<td>Student learning required depth of understanding to be demonstrated relating to content and process skills.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discourse Factors</th>
<th>Pre-Inquiry (Level 1)</th>
<th>Developing Inquiry (2)</th>
<th>Proficient Inquiry (3)</th>
<th>Exemplary Inquiry (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1. Questioning Level</td>
<td>Questioning rarely challenged students above the remembered level.</td>
<td>Questioning rarely challenged students above the understanding level.</td>
<td>Questioning challenged students up to application or analytic levels.</td>
<td>Questioning challenged students at various levels, including at the analysis level or higher; level was varied to scaffold learning.</td>
</tr>
<tr>
<td>D2. Complexity of Questions</td>
<td>Questions focused on one correct answer, typically short answer responses.</td>
<td>Questions focused mostly on one correct answer; some open response opportunities.</td>
<td>Questions challenged students to explain, reason, and/or justify.</td>
<td>Questions required students to explain, reason, and/or justify; students were expected to critique others’ responses.</td>
</tr>
<tr>
<td>D3. Questioning Ecology</td>
<td>Teacher lectured or engaged students in oral questioning that did not lead to discussion.</td>
<td>Teacher occasionally attempted to engage students in discussions or investigations but was not successful.</td>
<td>Teacher successfully engaged students in open-ended questions, discussions, and/or investigations.</td>
<td>Teacher consistently and effectively engaged students in open-ended questions, discussions, investigations, and/or reflections.</td>
</tr>
<tr>
<td>D4. Communication Pattern</td>
<td>Communication was controlled and directed by teacher and followed a didactic pattern.</td>
<td>Communication was typically controlled and directed by teacher, with occasional input from other students; mostly didactic pattern.</td>
<td>Communication was often conversational with some student questions guiding the discussion.</td>
<td>Communication was consistently conversational with student questions often guiding the discussion.</td>
</tr>
<tr>
<td>D5. Classroom Interactions</td>
<td>Teacher accepted answers, connecting when necessary, but rarely followed-up with further probing.</td>
<td>Teacher or another student occasionally followed-up student response with further open-level probe.</td>
<td>Teacher or another student often followed-up response with engaging probe that required student to justify reasoning or evidence.</td>
<td>Teacher consistently and effectively facilitated rich classroom discussions where evidence, assumptions, and reasoning were challenged by teacher or other students.</td>
</tr>
</tbody>
</table>

### VI. Assessment Factors

<table>
<thead>
<tr>
<th>Construct Measured</th>
<th>Pre-Inquiry (Level 1)</th>
<th>Developing Inquiry (2)</th>
<th>Proficient Inquiry (3)</th>
<th>Exemplary Inquiry (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1. Prior Knowledge</td>
<td>Teacher did not assess student prior knowledge</td>
<td>Teacher assessed student prior knowledge but did not modify instruction based on this knowledge</td>
<td>Teacher assessed student prior knowledge and then partially modified instruction based on this knowledge</td>
<td>Teacher assessed student prior knowledge and then modified instruction based on this knowledge</td>
</tr>
<tr>
<td>A2. Conceptual Development</td>
<td>Teacher encouraged learning by memorization and repetition</td>
<td>Teacher encouraged prestate or answer-focused learning activities that lacked critical thinking</td>
<td>Teacher encouraged process-focused learning activities that required critical thinking</td>
<td>Teacher encouraged process-focused learning activities that involved critical thinking that connected learning with other concepts</td>
</tr>
<tr>
<td>A3. Student Reflection</td>
<td>Teacher did not explicitly encourage students to reflect on their own learning</td>
<td>Teacher explicitly encouraged students to reflect on their learning but only at a minimal knowledge level</td>
<td>Teacher explicitly encouraged students to reflect on their learning at an understanding level</td>
<td>Teacher consistently encouraged students to reflect on their learning at multiple levels throughout the lesson; encouraged students to think at higher levels</td>
</tr>
<tr>
<td>A4. Assessment Type</td>
<td>Formal and informal assessments measured only formal, discrete knowledge</td>
<td>Formal and informal assessments measured mostly factual, discrete knowledge</td>
<td>Formal and informal assessments used both factual, discrete knowledge and authentic measures</td>
<td>Formal and informal assessment methods consistently and effectively used authentic measures</td>
</tr>
<tr>
<td>A5. Role of Assessing</td>
<td>Teacher solicited premeditated answers from students; requiring little explanation or justification</td>
<td>Teacher solicited information from students to assess understanding</td>
<td>Teacher solicited explanations from students to assess understanding and then adjusted instruction accordingly</td>
<td>Teacher frequently and effectively assessed student understanding and adjusted instruction accordingly; challenged evidence and claims made; encouraged curiosity and openness</td>
</tr>
</tbody>
</table>

### VII. Curriculum Factors

<table>
<thead>
<tr>
<th>Construct Measured</th>
<th>Pre-Inquiry (Level 1)</th>
<th>Developing Inquiry (2)</th>
<th>Proficient Inquiry (3)</th>
<th>Exemplary Inquiry (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1. Content Depth</td>
<td>Lesson provided only superficial coverage of content.</td>
<td>Lesson provided some depth of content but with no connections made to the big picture.</td>
<td>Lesson provided depth of content with some significant connection to the big picture.</td>
<td>Lesson provided depth of content with significant, clear, and explicit connections made to the big picture.</td>
</tr>
<tr>
<td>C2. Learner Centeredness</td>
<td>Lesson did not engage learner in activities or investigations.</td>
<td>Lessons provided prescribed activities with anticipated results.</td>
<td>Lessons allowed for some flexibility during investigation for student-designed exploration.</td>
<td>Lessons provided flexibility for students to design and carry out their own investigations.</td>
</tr>
<tr>
<td>C3. Integration of Content and Investigation</td>
<td>Lessons either content-focused or activity-focused but not both.</td>
<td>Lessons provided poor integration of content with activity or investigation.</td>
<td>Lessons incorporated student-generated exploration that linked well with content.</td>
<td>Lessons seamlessly integrated the content and the student investigation.</td>
</tr>
<tr>
<td>C4. Organizing &amp; Recording Information</td>
<td>Students organized and recorded information in prescriptive ways.</td>
<td>Students had only minor input as to how to organize and record information.</td>
<td>Students regularly organized and recorded information in non-prescriptive ways.</td>
<td>Students organized and recorded information in non-prescriptive ways that allowed them to effectively communicate their learning.</td>
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### VIII. Summative Overviews *

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<tr>
<th>Summative view of Instruction</th>
<th>Comprehensive Score**</th>
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<tbody>
<tr>
<td>Summative view of Discourse</td>
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<tr>
<td>Summative view of Assessment</td>
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<tr>
<td>Summative view of Curriculum</td>
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<tr>
<td>Overall view of Lesson</td>
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*Provide brief descriptive comments to justify score.

**Score for each component should be an integer from 1-4 that corresponds with the appropriate level of inquiry. Scores should reflect the essence of the lesson relative to that component, so they need not be an exact average of all sub-scores in a category.


Appendix E: Alignment of Inquiry Definition and EQUIP Rubric
### Alignment between Inquiry Definition and Inquiry Rubric

<table>
<thead>
<tr>
<th>Inquiry Definition</th>
<th>EQUIP Rubric</th>
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<tr>
<td>“Inquiry is learning by questioning and investigation; the questions asked and means for investigation are vast, nonlinear, and idiosyncratic. Inquiry encompasses diverse ways to study phenomena in all subject areas through dialogue, asking questions, and proposing explanations based on empirical evidence (NRC, 1996). A requirement of inquiry is that the goal of learning is ‘to do’ and learn ‘about’ at the same time. Inquiry requires imaginative, evidence-based explanations achieved through critical thinking, and a deep understanding of concepts” (Shore, <em>et al</em>; 2009, p. 141).</td>
<td>Measures levels of questioning and investigation: Pre-inquiry, Developing Inquiry, Proficient Inquiry, or Exemplary Inquiry</td>
</tr>
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</table>
### Alignment between Inquiry Definition and Inquiry Rubric (continued)

<table>
<thead>
<tr>
<th>Inquiry Definition</th>
<th>EQUIP Rubric</th>
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<tbody>
<tr>
<td>Learning by questioning and investigation</td>
<td>Student questioning led the discussion; students engaged in open-ended</td>
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<tr>
<td></td>
<td>discussion and investigations</td>
</tr>
<tr>
<td>Questions are vast, non-linear, idiosyncratic; open-ended</td>
<td>Questioning at the analysis level; students critique peers’ responses; open-ended</td>
</tr>
<tr>
<td>discussions</td>
<td>discussions, questions, investigations, conversational discourse between teacher and students</td>
</tr>
<tr>
<td>Dialogue; students explain, reason, justify; proposing explanations based on empirical evidence</td>
<td>Classroom dialogue where evidence, assumptions, and reasoning were challenged by the teacher or students; students organized and recorded information in non-prescriptive ways that allowed them to effectively communicate their learning</td>
</tr>
<tr>
<td>Inquiry Definition</td>
<td>EQUIP Rubric</td>
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<td>----------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Diverse ways to study phenomena; goal is “to do” and “to learn about” at the same time</td>
<td>Students were consistently and effectively active as learners; students provided the explanation; teacher consistently and effectively engaged students in open-ended questions, discussions, investigations, and/or reflections</td>
</tr>
<tr>
<td>Critical thinking and a deep understanding of concepts</td>
<td>Student learning required depth of understanding to be demonstrated relating to content and process skills; students were engaged in investigations that promoted strong conceptual understanding</td>
</tr>
</tbody>
</table>

(Marshall, Horton, Smart, & Llewellyn, 2009; Shore, Birlean, Walker, Ritchie, LaBanca, & Aulls, 2009)
Appendix F: Problem-solving Styles Model of VIEW: An Assessment of Problem-solving Style
Problem-solving Style Model of VIEW: An Assessment of Problem-solving Style

The purpose of VIEW: An Assessment of Problem-solving Style (Treffinger, Selby, Isaksen, & Crumel, 2007) is to measure six problem-solving styles along three dimensions. Problem-solving styles refer to a person’s preferred ways of responding to change. Within the Orientation to Change dimension, one can be either an Explorer or a Developer. An Explorer prefers to devise new solutions to problems, while a Developer prefers to work with what already exists and try to improve upon it. Within Manner of Processing, one’s problem-solving style can be either External or Internal. Some people prefer to share and discuss with others how to solve a problem, while others prefer to work on the problem internally and only share when a solution presents itself. Within the third dimension, Ways of Deciding, one can be either Person-oriented or Task-oriented, making decisions based on the good of the people involved or according to the requirements of the task at hand.

There are 34 items on a 7-point Likert scale. The instrument is appropriate for ages 12 to adult. All items are stated in a positive way and no problem-solving style is considered better than another. The scores indicate the type of problem-solving style preferred by the responder. A moderate score is provided for those who fall between the styles. Those in the moderate category do not strongly favor either extreme, but may have characteristics of both. Alpha coefficients for reliability of the three dimensions range from .87 for both Manner of Processing and Deciding, to .91 for Orientation to Change. Construct validity is still in process, but includes exploratory factor analysis.
Appendix G: Letter and Consent Form (Superintendent)
Dear _____________________,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. The purpose of the study is to understand teacher use of inquiry strategies in instruction. Research has shown inquiry to be a motivating, engaging method of learning that is useful in teaching 21st Century Skills. In addition, the state of Connecticut has recently released teacher competencies stressing the importance of inquiry and active learning for students. There have been several studies of teacher use of inquiry, but none have addressed the perspectives of experienced elementary school teachers. Because of this, I wish to investigate the perceptions of third and fourth grade teachers who have taught for at least five years, in order to comprehend their use of inquiry strategies in the classroom.
This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board. There are no perceived risks related to participation in this study. Results of this study will enable educators to understand how inquiry strategies are presently being employed in the classroom. The information could be used to remove barriers to inquiry use and to increase catalysts to encourage the use of inquiry teaching. The results of the study will be shared with administrators and teachers. Participation in this study is completely voluntary. Teachers who agree to participate will be invited to complete a 10-minute survey about their teaching styles. A sub-sample of 8 to 10 teachers will be asked to participate in one or two hour-long observations, complete a 10-minute problem-solving styles instrument, and provide their perceptions of inquiry in a one hour-long interview outside of school hours. This subgroup will be given a small gift certificate to a book store. The teacher surveys and responses will be coded to ensure confidentiality. The names of the districts, schools, and teachers will be given pseudonyms. The information gathered from this research will not be used to evaluate any individuals. Individual responses will only be shared with the specific teacher who provided the information.

If you have any questions, please feel free to contact me. Your district’s participation in this study is completely voluntary. If you agree to allow teachers in your district’s third and fourth grade to participate in this study, please sign the form and return it to me.

Thank you for your attention and time.

Sincerely,
I agree that the study described above can be conducted in __________
Public Schools.

__________________________________
Please Print Name

__________________________________  __________________
Signature  Date
Appendix H: Permission Letter for Principals
Dear Principal,

I am currently enrolled in the doctoral program for Instructional Leadership at Western Connecticut State University. This program requires that I design and implement a dissertation research study. Please accept this letter as my formal request for you to take part in this research study. This research will take place in the spring of 2011. This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board.

The purpose of the study is to understand teacher use of inquiry in instruction. Research has shown inquiry to be a motivating, engaging method of learning that is useful in teaching 21stCentury Skills. In addition, the state of Connecticut has recently released teacher competencies stressing the importance of inquiry and active learning for students. There have been several studies of teacher use of inquiry, but none have addressed experienced teachers (teachers who have taught for at least five years) teaching grades 3 and 4. Because of this, I wish to observe and interview experienced teachers who do and do not use inquiry to comprehend the catalysts for using it, as well as the barriers.

First, I would like to ask all of your third and fourth grade teachers to complete the Survey to Identify Teaching Styles survey on a voluntary basis. Several teachers may be selected for the study on the basis of their responses. Those chosen to participate in the study will then undergo one or two hour-long observations, complete a five-minute problem-solving styles inventory, and finally participate in an hour-long interview outside of school hours.
Participation in this study is completely voluntary. The interviews will be coded to ensure that all responses will be held strictly confidential. Schools and districts will be given pseudonyms. Copies of the results of the study, as well as your school-wide results will be made available to you; please indicate below your interest in receiving your school’s data. Individual teacher responses will not be made available.

If you have any questions, or would like further information about the study, please contact me. Thank you for your cooperation and contribution to this research study. Please sign and return this form in the enclosed pre-addressed envelope, or indicate your consent to participate in the follow-up e-mail that you will be receiving shortly.

Sincerely,

☐ I would like to receive results of this research study.

☐ I would like to receive data for my school.

Participant Signature________________________________________ Date ______________
Appendix I: Teacher Permission Letter and Letter for Acceptance into the Study
Dear Teacher,

I am a doctoral student at Western Connecticut State University. To complete my degree, I am conducting a study investigating the use of teaching styles. I am asking you to voluntarily complete a five minute survey form to share your teaching practices. I will use the results from the survey to choose a sample of eight to ten teachers who will participate in one or two follow-up observations, an hour-long interview outside of school hours, and a problem-solving styles assessment. I will use the information gathered to understand current teaching practices. Teachers who are chosen for the final sample will receive a $15.00 gift certificate to Barnes & Noble’s book stores upon completion of the study.

Thank you for your cooperation and contribution to this research study. I will collect the survey from your school on____________________________. If you have any questions, please contact me.

Sincerely,
This letter is intended to serve as a consent form in my formal request for your participation in my doctoral research study in instructional leadership at Western Connecticut State University. The purpose of the study is to understand teacher use of methodologies and practices. I would like to observe your teaching style once or twice, and I would like to interview you regarding your beliefs and practices in teaching. A problem-solving styles assessment, *VIEW: An Assessment of Problem-solving Style* will be administered. It takes about five minutes and informs you about your particular problem-solving style.

This research study has been reviewed and approved by Western Connecticut State University’s Institutional Review Board. Results of this study will enable educators to better understand the effects of various teaching methods.

**Participation in this study is completely voluntary.** The interviews will be coded to ensure that all responses will be held strictly confidential. Individual teacher responses will not be made available. A copy of the results will be available upon request. Individual teacher results will not be available to principals or other district personnel. Furthermore, you may decide at any time not to continue in the study. I appreciate your willingness to participate in this research study. In appreciation for your participation, you will receive a $15.00 Barnes and Noble gift certificate upon completion of the study.
Please sign the consent form at the bottom of this letter. You can sign and return it to me in the pre-addressed envelope, or you will receive an e-mail shortly offering you the opportunity to provide your consent via e-mail.

Thank you for your cooperation and contribution to this research study.

Sincerely,

Susan H. Guertin

I freely consent to participate in Susan Guertin’s research project at Western Connecticut State University this spring semester, 2011. I consent to one or two observations of my teaching, completing the VIEW: An Assessment of Problem-solving Style, and to a semi-structured interview outside of school hours. I may decide not to continue at any time for any reason.

Participant Signature ________________________________

Date_______________ Grade level taught_______

Please print name ________________________________

Participant e-mail______________________________

Susan H. Guertin

Western Connecticut State University
Appendix J: Data Collection Timeline and Ethics Statement
Data Collection Timeline

March, 2011
Proposal
IRB Process

September, 2011
Select sample from survey

Fall Semester, 2011
Data Collection, Begin Analysis
Ethics Statement

This proposal was submitted to the Internal Review Board at Western CT State University for approval. Permission to participate in this research was sought from each district’s superintendent, each school principal, and all participating teachers. To assure confidentiality, each participant was assigned a coded pseudonym. All data was collected by the researcher and kept in a secure location. The data are available to those participating superintendents, principals, and teachers who request it. Any data that identifies individual teachers will not be shared.
Appendix K: Code Definitions by Theme, Alphabetically
<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age and experience</td>
<td>Age</td>
<td>Teacher’s age</td>
</tr>
<tr>
<td></td>
<td>Number of years of teaching</td>
<td>Number of years teaching</td>
</tr>
<tr>
<td>experience</td>
<td>experience</td>
<td></td>
</tr>
<tr>
<td>2. Beliefs about educational</td>
<td>No voice in change</td>
<td>Teachers felt unheard by the state and district and did not think they had</td>
</tr>
<tr>
<td>change</td>
<td>Teacher empowerment</td>
<td>input into changes</td>
</tr>
<tr>
<td></td>
<td>Teacher feelings about change</td>
<td>Positive or negative feelings toward change</td>
</tr>
<tr>
<td>3. Collaboration</td>
<td>Coaching</td>
<td>Need for teacher support by a coach or mentor</td>
</tr>
<tr>
<td></td>
<td>Helping others to implement</td>
<td>Teachers act as peer coaches</td>
</tr>
<tr>
<td>learning</td>
<td>inquiry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teacher partnerships to support</td>
<td>Teachers working together to implement inquiry</td>
</tr>
<tr>
<td></td>
<td>inquiry learning</td>
<td></td>
</tr>
</tbody>
</table>

352
<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEAM</td>
<td>Too much change at one time</td>
<td>Teachers experienced feelings of being overwhelmed by too many changes</td>
</tr>
<tr>
<td></td>
<td>Unrealistic expectations</td>
<td>State and districts asking too much of students and teachers</td>
</tr>
<tr>
<td>4.</td>
<td>Direct instruction practices</td>
<td>Efficiency</td>
</tr>
<tr>
<td></td>
<td>Review</td>
<td>Direct instruction used to review previously learned material</td>
</tr>
<tr>
<td></td>
<td>Teacher-focused</td>
<td>Teacher as the focus of the lesson</td>
</tr>
<tr>
<td>Theme</td>
<td>Code</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5. Mandated change</td>
<td>Access to appropriate materials</td>
<td>Grade- and ability-level materials, cache of materials ready to use</td>
</tr>
<tr>
<td></td>
<td>Lack of time and training</td>
<td>Test preparation, planning and reflection, no professional training to implement changes</td>
</tr>
<tr>
<td></td>
<td>State standards</td>
<td>Teachers need to learn how to implement them in inquiry lessons, important to student learning</td>
</tr>
<tr>
<td>6. Mandated testing</td>
<td>Technology concerns</td>
<td>Not enough computers, outdated equipment, loss of student work</td>
</tr>
<tr>
<td></td>
<td>Testing preparation</td>
<td>Preparation for high-stakes tests</td>
</tr>
</tbody>
</table>
### Code Definitions (continued)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing pressure</td>
<td>Pressure on students and teachers to achieve on one measure of knowledge</td>
<td></td>
</tr>
<tr>
<td>Testing pressure</td>
<td>Too much pressure on students and teachers to do well</td>
<td></td>
</tr>
<tr>
<td>7. Parent feedback</td>
<td>Parent pressure</td>
<td>Parents want students to learn content at same rate as other classes</td>
</tr>
<tr>
<td>Parent reactions to inquiry practice</td>
<td>Parents want inquiry teaching method justified</td>
<td></td>
</tr>
<tr>
<td>8. Peer pressure</td>
<td>Discomfort caused by colleagues’ comments</td>
<td>Inquiry teachers questioned their own teaching, uncomfortable with peers</td>
</tr>
<tr>
<td>Pressure to conform to traditional teaching</td>
<td>Other teachers making remarks about inquiry as the wrong way to teach</td>
<td></td>
</tr>
</tbody>
</table>
### Code Definitions (continued)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Problem-solving style</td>
<td>Collaborative</td>
<td>Working with others to solve problems first</td>
</tr>
<tr>
<td></td>
<td>Individual</td>
<td>Thinking about the problem first, then working with others</td>
</tr>
<tr>
<td>10. Professional development</td>
<td>Consult/coaching</td>
<td>Teacher desire for assistance by a coach to implement inquiry</td>
</tr>
<tr>
<td></td>
<td>Gradual learning of inquiry practices</td>
<td>Teachers should learn to implement inquiry at their own pace, not rushed</td>
</tr>
<tr>
<td></td>
<td>Limited training, knowledge</td>
<td>Teacher statements indicated little knowledge of inquiry or content</td>
</tr>
<tr>
<td>Theme</td>
<td>Code</td>
<td>Definition</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Professional learning</td>
<td>Lack of opportunities, topics covered</td>
</tr>
<tr>
<td></td>
<td>Teachers as learner</td>
<td>Teachers continued learning about content and teaching methods</td>
</tr>
<tr>
<td>11.</td>
<td>Program support</td>
<td>Administrative support</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administrators support teacher use of inquiry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Appropriate materials for inquiry implementation</td>
</tr>
<tr>
<td></td>
<td>Support staff in classroom</td>
<td>Need for paraprofessionals, volunteers or content experts</td>
</tr>
<tr>
<td>12.</td>
<td>State standards</td>
<td>Implementation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Guidance on how to implement standards, discussion about how standards are being implemented</td>
</tr>
<tr>
<td></td>
<td>Importance</td>
<td>Teacher beliefs in the importance of standards</td>
</tr>
<tr>
<td>Theme</td>
<td>Code</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>13. Student engagement</td>
<td>Attention</td>
<td>High, low</td>
</tr>
<tr>
<td></td>
<td>Enjoyment</td>
<td>Degree observed</td>
</tr>
<tr>
<td></td>
<td>Involvement</td>
<td>High, low</td>
</tr>
<tr>
<td>14. Teacher emotions</td>
<td>Attitude toward instructional change</td>
<td>Positive or negative emotions</td>
</tr>
<tr>
<td></td>
<td>Concerns</td>
<td>Teacher concerns about education</td>
</tr>
<tr>
<td></td>
<td>Confidence</td>
<td>Ability and knowledge to implement inquiry</td>
</tr>
<tr>
<td></td>
<td>Enjoyment of content area</td>
<td>Teacher enjoyment of science</td>
</tr>
<tr>
<td></td>
<td>Teachers wary about the perceived</td>
<td>Fear of losing control of class</td>
</tr>
<tr>
<td></td>
<td>openness in inquiry</td>
<td></td>
</tr>
</tbody>
</table>
**Code Definitions (continued)**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest in science</td>
<td>Teachers’ level of interest</td>
<td></td>
</tr>
<tr>
<td>Passion for teaching</td>
<td>Teacher’s expression of enthusiasm for teaching</td>
<td></td>
</tr>
<tr>
<td>Political statements</td>
<td>Teacher statements about the politics of change</td>
<td></td>
</tr>
<tr>
<td><strong>Teacher experience</strong></td>
<td><strong>Yes, no</strong></td>
<td>Inquiry experiences in school, college</td>
</tr>
<tr>
<td>with inquiry as students</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Teacher knowledge of instructional practices</strong></td>
<td>Bloom’s Taxonomy (Bloom, 1956)</td>
<td>Levels of intellectual thinking</td>
</tr>
<tr>
<td></td>
<td>Data-driven decision-making</td>
<td>Teachers use student data to determine what and how to teach</td>
</tr>
<tr>
<td></td>
<td>Differentiation</td>
<td>Adjusting instruction to the individual’s learning needs</td>
</tr>
</tbody>
</table>
### Code Definitions (continued)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct instruction practice</td>
<td></td>
<td>Teacher knowledge and use of direct instruction</td>
</tr>
<tr>
<td>Inquiry practices</td>
<td></td>
<td>Teacher knowledge and use of inquiry practices</td>
</tr>
<tr>
<td>Knowledge of content area</td>
<td></td>
<td>Teacher knowledge, especially in science</td>
</tr>
<tr>
<td>Research process</td>
<td></td>
<td>Clear process used in classroom, or not</td>
</tr>
<tr>
<td>Scaffolding student learning</td>
<td></td>
<td>Breaking learning into parts and building student knowledge on previous learning</td>
</tr>
<tr>
<td>Science fair</td>
<td></td>
<td>Use of science fair for research purposes</td>
</tr>
<tr>
<td>17. Teacher knowledge of</td>
<td>Exploring</td>
<td>Students allowed to explore their own ideas during a lesson</td>
</tr>
<tr>
<td>inquiry practices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theme</td>
<td>Code</td>
<td>Definition</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Following student questions</td>
<td>Allow students to ask and answer their own questions</td>
<td>hands-on learning</td>
</tr>
<tr>
<td>Risk-taking</td>
<td>Teacher feels free to take risks to try new approaches</td>
<td>shared discussion</td>
</tr>
<tr>
<td>Social learning</td>
<td>Students involved in group or partner work to build knowledge together</td>
<td></td>
</tr>
<tr>
<td>Theme</td>
<td>Code</td>
<td>Definition</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Student-centered</td>
<td>Student as focus of the lesson</td>
<td></td>
</tr>
<tr>
<td>Student choice</td>
<td>Students asking, answering their own questions using their own ideas</td>
<td></td>
</tr>
<tr>
<td>Student explaining</td>
<td>Students expected to explain concepts, justify their answers</td>
<td></td>
</tr>
<tr>
<td>Teacher as facilitator</td>
<td>Teacher facilitates lessons for students instead of directly teaching material</td>
<td></td>
</tr>
<tr>
<td>18. Teacher pedagogical beliefs</td>
<td>Benefits of inquiry</td>
<td>Teacher belief that inquiry is beneficial to student learning</td>
</tr>
<tr>
<td>Developmentally appropriate practice</td>
<td>Teacher understanding of appropriate instruction based on student age and developmental needs</td>
<td></td>
</tr>
<tr>
<td>Doing what is right for kids</td>
<td>Teacher beliefs about the best way to teach students</td>
<td></td>
</tr>
</tbody>
</table>
### Code Definitions (continued)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Code</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>How students learn</td>
<td>Teacher beliefs about how they think students learn best</td>
<td></td>
</tr>
<tr>
<td>19. Teaching style</td>
<td>Classroom management</td>
<td>Teacher beliefs and practices regarding classroom management</td>
</tr>
<tr>
<td>Free thinkers</td>
<td>Teachers open to new ideas</td>
<td></td>
</tr>
<tr>
<td>Generational factors</td>
<td>Difference in style due to age, generation</td>
<td></td>
</tr>
<tr>
<td>Rule followers</td>
<td>Teachers do whatever is asked by their superiors</td>
<td></td>
</tr>
<tr>
<td>Self-perception</td>
<td>How teachers see themselves as educators</td>
<td></td>
</tr>
<tr>
<td>Teacher flexibility</td>
<td>Ability to change or adapt to circumstances</td>
<td></td>
</tr>
<tr>
<td>Traditional teaching style</td>
<td>Utilizing primarily direct instruction</td>
<td></td>
</tr>
<tr>
<td>Theme</td>
<td>Code</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>20. Time constraints</td>
<td>Curriculum overload</td>
<td>Curriculums too dense, too much content to teach</td>
</tr>
<tr>
<td></td>
<td>Personal life</td>
<td>Teaching responsibilities interfere with personal life with family</td>
</tr>
<tr>
<td></td>
<td>No time for reflection</td>
<td>More time needed to reflect on teaching practice</td>
</tr>
<tr>
<td></td>
<td>Teacher preparation/planning time</td>
<td>Not enough time during school day</td>
</tr>
<tr>
<td>21. Types of questions</td>
<td>Higher order thinking questions</td>
<td>Questions that require students to analyze, apply, evaluate, or create</td>
</tr>
<tr>
<td>posed by teacher and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>students</td>
<td>Lower order thinking questions</td>
<td>Questions that ask students to remember or understand</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix L: Code Frequencies for Individual Subjects
### Code Frequencies for Individual Subjects

<table>
<thead>
<tr>
<th>Codes</th>
<th>Lauren</th>
<th>Connie &amp; Pam</th>
<th>Kelly</th>
<th>Kristin</th>
<th>Alex</th>
<th>Simone</th>
<th>Cathy</th>
<th>Linda</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative support</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Barriers</td>
<td>2</td>
<td>15</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>43</td>
</tr>
<tr>
<td>Benefits of inquiry</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Bloom’s Taxonomy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Catalysts</td>
<td>0</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>22</td>
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<tr>
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375
Code Frequencies for Individual Subjects (continued)

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376
### Code Frequencies for Individual Subjects (continued)

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**Code Frequencies for Individual Subjects (continued)**

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