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Beliefs concerning science reform

SCIENCE TEACHERS' BELIEFS CONCERNING REFORM POLICIES:
COMPARISONS BASED ON GRADE LEVEL, ACHIEVEMENT HISTORY,
AND SOCIOECONOMIC STATUS

by

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A dissertation submitted in partial fulfillment of the requirements
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ABSTRACT

In an effort to increase the relevance and rigor of the science curriculum being taught in schools throughout Florida, the Next Generation Sunshine State Standards were developed and districts throughout the state began processing them for use in the K-12 classrooms. With a history of adopt and abandon reform strategies, one district wanted to follow a more structured implementation approach to better ensure a successful transition to the new standards. As the first aspect of the approach, teachers in grades 3-8 were asked to complete two instruments which gauged their beliefs regarding the Next Generation Standards in science. Quantitative analysis of the responses revealed differences in beliefs among teachers at different grade levels, at schools with different socio-economic statuses, and at schools with different standardized test performance histories. Qualitative analysis uncovered the nature of the differences and allowed for a clearer view of the current state of science reform in the district.

For my daughter Sofie,
who is a constant source of inspiration,
and my mpenzi Perry,
who has fulfilled all my dreams
You are both my sunshine.

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CHAPTER ONE: INTRODUCTION

In an age of accountability and assessment, national science reform policies have been implemented for almost every subject and at every grade level to attempt to find ways to improve the education system (U.S. Department of Education, 2004). Science education in our country has a long history of proposing and discussing reforms, and then reacting with frustration over the lack of effectiveness of the reforms (Bianchini & Kelly, 2003). The effectiveness of these science reform efforts have been found to be highly correlated to teacher beliefs towards the reform policies (Smith & Southerland, 2007). Smith and Southerland reported that traditionally, teachers' beliefs "have profoundly impacted the way they have interpreted reforms as well as how (or if) changes have been enacted in their classrooms" (p. 415). On the flip side: "Reforms call for radical changes in teachers' knowledge and beliefs about subject matter, teaching, children, and learning" (van Driel, Beijaard, & Verloop, p.140, 2001). Therefore research has shown that teachers' beliefs affect reform implementation and conversely that reforms are often written in part to affect beliefs. This is a vicious cycle or a relationship that could be used as an educational advantage to create meaningful and practical reforms?

The study presented here examined teachers' beliefs about current science reform efforts and determined whether those beliefs differed depending on the climate of the school in which the teacher worked (ex. socioeconomic status and assessment performance) and/or grade level the teacher taught (ex. middle school vs elementary school). Comparisons of teacher beliefs across grade levels were essential since elementary schools have been found to be more successful in implementing science reform than other grade levels (Corcoran & Christman, 2002). Additionally, in the school district under study, there were separate mechanisms in place

for disseminating information in elementary and middle schools which potentially affected how the reform was received by the different grade levels. Comparisons across schools based on achievement history and socioeconomic status were selected because studies have reported that teachers develop their beliefs and implementation of science reform through the context of their individual school (Schneider, Krajcik, & Blumenfeld, 2005; Smith & Southerland, 2007).

School-based differences were also critical because often professional development in the school district being studied had been structured toward and/or given by the individual school rather than district-wide.

A full picture of the response to reform in this school district included three components: the beliefs of the teachers prior to implementation (“before”), the structure necessary as the reform is being implemented (“during”), and the support required to ensure the success of the reform once it has been started (“after”). The immediate goal of this research was to determine whether science teacher beliefs varied concerning the upcoming transition to a curriculum based on the Next Generation Sunshine State Standards (NGSSS). Therefore the focus of the study was on the “before” aspect of the reform. The intent was not to change teacher beliefs but to understand them in order to discover ways to promote the internal motivation necessary for teachers to see the positive value in the reform (Lumpe, Haney, & Czerniak, 2000). This would address the “during” aspect of the reform. The data analysis results would be valuable as the school district progressed in the future. This information would support and potentially increase the likelihood that the reform effort was more effective (in other words allowing a look toward the “after” component of the reform). Only after analyzing teachers’ beliefs, could effective change be initiated and ultimately sustained. “Change cannot be blindly implemented without the

need to recognize the role of the classroom teacher and their beliefs” (Keys, p. 500, 2005).

Furthermore, understanding teacher beliefs when considering the support they will require once the science reform has been implemented is crucial to the success of any reform effort (Schneider, et al, 2005). Structures and support measures taken before (i.e. information gathering of teacher beliefs), during (i.e. professional development), and after (i.e. action plan for support) teachers are ultimately asked to begin teaching to the NGSSS are all critical to success of the overall science reform. Considerations for the action plan and professional development strategies once the Next Generation Standards are in place can be found in the final chapter of this work.

The reform policies about which teacher beliefs are measured, may start years before the teachers are asked to use the policies. Understanding the “before” component of the reform picture begins well outside of schools. Research around the country demonstrates that what is created in board rooms in Washington eventually arrives in classrooms but teachers and politicians do not always agree on what education should look like (Eisenhart, Cuthbert, Shrum, & Harding, 2001; Smith & Southerland, 2007). The philosophical differences among all the stakeholders in education can affect a national policy in many ways by the time it reaches the students for which it was intended (Eisenhart, et al, 2001). Roehrig and Kruse (2005) found that there was little evidence to support that the practices suggested by national standards are reflected in teacher pedagogy. Eisenhart, et al (2001) point out that unexpected outcomes can happen when the beliefs of those affected by the policies are not considered. Furthermore, it has been reported, that science reforms are doomed to failure without the support of teachers (Hurd, 2000, van Driel, et al, 2001, Smith & Southerland, 2007). Bianchini and Kelly (2003) advocate

allowing teachers to participate in the process of translating standards into practice. Similarly, Keys and Bryan (2001) stated that teachers must have a “legitimated and empowered” (p. 636) role in science reform if the change is expected to be sustained. In order to garner the support of teachers and honor their beliefs, educational leaders must first determine what science teachers believe concerning a particular science reform effort.

In order to create successful structures during the reform process, understanding of teacher beliefs must be established before the reform has started. But beyond just describing current science teacher beliefs, some possible reasons for differences in beliefs among teachers should be discovered (Lumpe, et al, 2000). Beliefs based on prior experiences become the standard by which new information is measured (Marbach-Ad & McGinnis, 2008). Therefore the past (educational history, experience teaching, etc...) is a piece of the picture that, although not in consideration here, would be a valuable research enterprise. This study took a snapshot of the current school environment based on socio-economic status and achievement history. Research of teacher beliefs concerning reform has reported contextual factors such as those as influences in the implementation of an initiative (Keys, 2005). Repeatedly this same finding of external influences on teacher beliefs has been documented in research (Schneider, et al, 2005; Shaver, Cuevas, Lee, & Avalos, 2007; Smith and Southerland, 2007). Shaver, et al, (2007) wrote that teachers altered their beliefs depending on what was considered critical in education at the time. They reported that particularly in elementary schools, content standards, statewide assessments, and accountability guided education rather than deeply held notions about education. However research also has also described instances when teacher beliefs outweigh the changes proposed by a reform. Smith and Southerland (2007) suggested that teachers often alter reforms more than

reforms alter teachers. Similarly, Schneider, et al (2005) reported that factors like the socioeconomic status of the school tend to keep teachers from altering their beliefs or faithfully implementing science reforms.

These various findings on teacher beliefs did not suggest a clear path to follow that would facilitate science reform after it is initiated but there seemed to be an undeniable link throughout research between beliefs and reform. Heck, Brandon, and Wang (2001) reported that improvement was possible only when the stakeholders were committed to the policy, support was provided from within and outside of the school, the science reform was customized to the individual school, and enough time was given for implementation and planning. Therefore an analysis of the beliefs of teachers participating in this current study potentially clarified the sources of teacher beliefs concerning science reform policies in the district under study. Since “reform curricula...typically strongly depart from what teachers are accustomed to using in their vision of the discipline and corresponding pedagogy and consequently the kinds of thinking in which children are expected to engage” (Metz, p. 950, 2009). A foundational premise of this study was that a detailed understanding of current teacher beliefs was necessary in order to facilitate the implementation of the science reform.

Research Questions

The research questions which guided this study were:

- Did science teachers’ beliefs about science reform policies differ between elementary (grades 3-5) and middle (grades 6-8) school teachers?
- Did science teachers’ beliefs about science reform policies differ between schools based on SES (as determined by free or reduced lunch percentage)?

- Did science teachers' beliefs about science reform policies differ between schools based on their previous assessment performance (as determined by prior year's FCAT Science scores)?

Hypotheses

-Elementary (grades 3-5) science teacher beliefs concerning the science reform policy will differ from middle school (grades 6-8) science teacher beliefs.

-Science teachers in schools with fewer students on free or reduced lunch will have different beliefs about the science reform than those in schools with more students on free or reduced lunch.

-Science teachers in schools that had more students receive a Level 3 or higher on the 2008 Science FCAT, will have different beliefs about the science reform than those in schools that had fewer students receive a Level 3 or higher.

Definitions

For the purposes of this study, important terms were defined as follows:

"science teachers": any teacher in grades 3-8 that was responsible for providing science instruction to students during the school day (including Science Specialists and Exceptional Education teachers if relevant)

"beliefs": the statements teachers hold to be true about science reform policies as determined by analysis of the Stages of Concern survey (George, Hall, and Stiegelbauer, 2006) that they complete.

"science reform": the impending transition to the Next Generation Sunshine State Standards for science in the district's curriculum, which would include an adjustment to a more integrated curriculum for middle school

"standardized test": Florida's FCAT Science assessment which has created a standardized testing environment since funding, scheduling, textbook adoptions, and faculty positions often revolve around the results of the test, as defined by Shaver, et al (2007).

“FCAT Level 3”: as determined by the Florida Department of Education (2008), a student was considered to be performing *on* grade level in their understanding of science concepts if they have achieved a Level 3 (on a scale of 1-5) on FCAT Science. Student scores began with Level 1, in which the student was considered to be performing more than two grade levels below their current grade level followed by Level 2, where the student was considered to be performing one to two grade levels below their current grade level. At the other end of the scale, a Level 4 student was considered to be performing one to two grade levels above their current grade level and a Level 5 student was considered to be performing more than two grade levels about their current grade level.

Teachers' beliefs concerning reform had been a much researched concept. In this study, the beliefs of teachers concerning a particular reform, the transition to the Next Generation Standards in science, were analyzed to determine how teachers felt about the reform. Chapter One presented the introduction to the study, including the research questions upon which the study was based, researcher hypotheses, and study definitions. In the organization of existing research, what was known about teachers' beliefs before, during, and after the implementation of

a science reform was analyzed. Chapter Two will present the theoretical framework that developed as a result of the analysis and then will summarize the research literature in support of the framework.

CHAPTER TWO: REVIEW OF LITERATURE

In this Chapter, previous research concerning teachers' beliefs about reform is presented beginning with the theoretical framework which was constructed as a result of the review of literature. The framework and the review were organized around several overarching concepts concerning science reform and teacher beliefs. First, the external factors which affect the science reform will be addressed: who developed the reform and what was the initial intent of the reform. Secondly, the research findings of how school-based factors, particularly socioeconomic status and standardized testing performance history, affect teachers' beliefs will be summarized. Lastly, the conclusions from research on how best to support science reform once implemented will be presented.

Theoretical Framework

In order to determine which factors to include for analysis, extant research was compiled to determine those characteristics in education which have been shown to have a strong influence over teachers' beliefs. The framework (Fig. 1) upon which the study presented here rests followed the reform process from development, to implementation, to support.

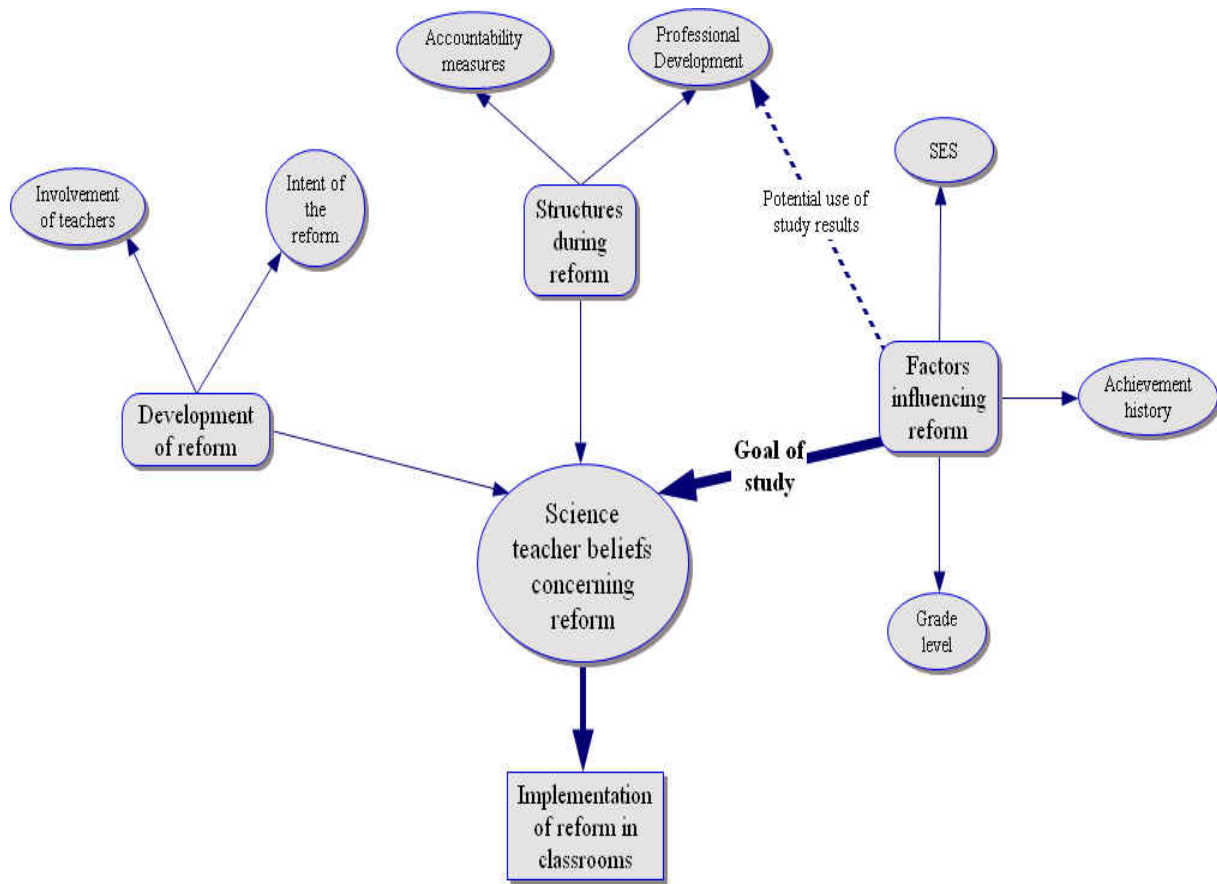


Figure 1: Theoretical Framework

The development of the science reform involved influences often outside of the school setting. The initial creation (“before”) of a science reform, for example national science standards, represented the first possibility for teacher beliefs to be shaped by external policies. The development process had two aspects which had been shown to affect its ultimate effectiveness: The initial intent of the science reform, and the amount of involvement that teachers have in the development (Keys and Bryan, 2001; Smith and Southerland, 2007). The implementation of the science reform (“during”), often begins with decisions and actions beyond the school walls which are then influenced by internal factors. Accountability measures

connected to the science reform during implementation (DeBoer, 2002; Diamond and Spillane, 2004) and professional development to support teachers after the implementation begins (Kim, Crasco, Blank, & Smithson, 2001; Roehrig and Kruse, 2005) have been found to affect teacher beliefs toward the reform.

While the previous factors can be beyond school-based control, there are additional factors that have been reported to influence teacher beliefs and their choices “after” implementation which directly involve the school itself. The school environment, particularly the overall SES of the school (Davis, 2003; King, Shumow, & Lietz, 2001; Schneider, et al, 2005; Snow-Renner, 2001), the achievement history of the school on standardized testing (Smith & Southerland, 2007; Snow-Renner, 2001), and whether the school is elementary or middle (Corcoran & Christman, 2002; Davis, 2003; Kim, et al, 2001; Snider & Roehl, 2007), have all been reported as having a significant influence on teacher beliefs concerning science reform. This study investigated to what extent these factors may influence science reform efforts in this purposefully selected school district.

The final piece of the theoretical framework (Fig. 1) addressed the underlying use of this research in the future. As indicated by the dashed arrow, it was a desired outcome of this study that a connection be made between the school-based factors which influence teacher beliefs and the support that will be provided to them. At the district level, it was beyond the scope of their responsibility to change the process of statewide or national science reform development, however the implementation of the reform (particularly professional development) was to some extent under the influence of district personnel. A finding that the schools have unique environments which affect teacher beliefs concerning science reform within this school district,

would seem to suggest logically that providers of professional development take those factors into account when designing the support structure during implementation (Roehrig & Kruse, 2005). This link between school environment and professional development will then hopefully be explored over the coming years after the science reform under study is implemented.

Underlying the research presented in this study was the argument explained previously that science teacher beliefs concerning a given reform effort vary based on several factors within the educational system (Keys, 2005; Shaver, et al, 2007; Smith & Southerland, 2007). Teacher beliefs as related to the science reform under consideration here were measured using the Stages of Concern Questionnaire derived out of the Concerns Based Adoption Model (George, et al, 2006). In using this model, researchers have found previously that a teacher's approach to reform can often be measured along a continuum from unconcerned to generating improvements. "Recognizing the stages and emotions corresponding with change can help us know what to expect in the change process..." (Gess-Newsome, Mensaco, & Clark, p. 19, 2009). An in-depth understanding of teacher beliefs concerning any science reform policy includes having a vision of the primary factors which influence those beliefs, ensuring that implementation efforts can be successful.

Teacher's beliefs are affected by multiple sources

Understandably, "when educational policy is formulated, the assumption is that it will influence what happens in classrooms and schools" (Eisenhart, et al, p. 137, 2001). In the face of national standards, state accountability measures, and school-based curricular goals it seems as if teachers have no say in what gets taught or how to teach it (Weiss, Pasley, Smith, Banilower, &

Heck, 2003). Teachers have reported at times feeling confused or disillusioned about the science reform policies being passed down to them (Smith & Southerland, 2007). Adding the pressure of accountability does not guarantee an instructional environment that matches the intention of the original science reform (Snow-Renner, 2001). Sustained change can only be realized when teachers are motivated to accept that the change is necessary (Keys, 2005). Studies continue to suggest that teacher beliefs are the greatest factor in the success or failure of any educational policy (Darling-Hammond & Ball, 1999; Eisenhart, et al, 2001; Keys, 2005; Smith & Southerland, 2007). So although much work is put into the creation and dissemination of policies, what teachers believe about these policies determines the way they are implemented. Lumpe, et al (2000) found through their development of an instrument to measure teacher beliefs, that although teacher beliefs are often resistant to change, they do not always coincide with what research says are best practices for student learning. Therefore understanding teacher beliefs is critical to predicting the future of science reform efforts (Shaver, et al, 2007).

To ensure that science teacher beliefs are based on a true understanding of the reform, it is recommended to provide teachers with knowledge of the specific expectations related to the science reform policies. Although being familiar with a policy does not ensure implementation (Crawford & Tindal, 2006), it may help clear up misconceptions. While some research has found the messages in science reform to be vague (DeBoer, 2002), others referred to some science reforms as outright contradictory to the messages of accountability and standardization (Smith & Southerland, 2007). Despite the efforts of national, state, and district leaders to create and disperse meaningful science reform, ultimately teachers are responsible for implementing any policy created (Eisenhart, et al, 2001). Finding importance in these science reform efforts may

require significant, fundamental alterations in teachers' belief systems (Smith & Southerland, 2007) and without seeing the importance, teachers will be reluctant to initiate change. To help with establishing importance, policy makers must plead the case that what the teachers are currently doing is obsolete so therefore change is necessary. Teachers must see the current methodology that the science reform is replacing as ineffective or unsuccessful before embracing new practices (Davis, 2003). There is often however, significant variability within the interpretations of the reform. "Only by understanding teachers' initial attempts at science reform and the range of enactments that are reasonable to expect, can we begin to develop materials that support a variety of teachers in making changes" (Schneider, et al, p. 307, 2005). The existence of rigid expectations by policy developers and within the support structure may hinder teachers' professional growth.

To determine the beliefs of teachers in respect to reform efforts and establish a clear vision of implementation, the Stages of Concern Questionnaire (George, et al, 2006) has been administered multiple times. Since 1969, the Stages of Concern Questionnaire (SoCQ) had gone through a series of piloting, revision, and analysis. During its inception, the focus of educational change of the 1960s and 1970s was primarily innovations, yet as the outcomes of the innovations repeatedly did not match the goals, studies began to determine what was involved during the process of change or adoption of innovations. One of these studies, Concerns-Based Adoption Model (CBAM), was based on the belief that individuals can affect change. The model has been used to identify particular needs of those who will be implementing any innovation so that facilitators can meet those needs and ensure its effectiveness. As part of the CBAM, which was designed to describe, explain, and predict behaviors during the change process, the Stages of

Concern Questionnaire serves as a framework to understand how change occurs on a personal level because as its authors stated "no matter what the school reform, someone still has to change" (p. 2).

Before science reform is implemented

When it comes to science reform, the initial ideas and policies have come in many forms with diverse purposes. As a basis for their study on a state-wide initiative to increase the participation of teachers in school-based decisions, Heck, et al (2001) cautioned that science reform policies "may set directions and provide a framework for change, but they do not determine the outcomes directly" (p. 303). National science reform policies are born generally out of a desire to remain competitive with international education systems and/or from attempts by politicians to regain control over what is traditionally a state run institution (Crawford & Tindal, 2006). For decades, these policy initiatives have resulted often times in newly created or adjusted national science standards (Darling-Hammond & Ball, 1999). The justification for science standards has frequently been the need for a unification of what is taught in our schools nation-wide and a need to create an assessment to determine the progress of our students toward mastery of the science content (NRC, 1996). Decisions about what curriculum should be taught is just the beginning of how national policy can influence classroom level instruction (Weiss, et al, 2003). This influence often depends on the how and why the policy was originally created. While initial science reform efforts generally include content, performance, and delivery standards, the final product delivered to teachers is often lacking in support for the instruction and heavy on assessment (Snow-Renner, 2001). It is assumed that the reform developers will

know what needs to be changed both in the curriculum and the teacher behaviors required to implement the reform, but both are not always given equal attention (van Driel, et al, 2001).

Historically, curriculum reform in science has been merely a reorganization of content to build rigor and update information rather than creating genuinely new curricula (Hurd, 2000). In general, science reforms begin with writing teams looking to create statements about what students should know and be able to do as they progress through school (Snow-Renner, 2001). As a result of one example of these efforts, in 1993 the American Association for the Advancement of Science released the Benchmarks for Science Literacy. The Benchmarks were meant as a tool for educators to create their own curriculum rather than as a standardized national curriculum. Written as a response to the growing trend of science illiteracy and international failure, the Benchmarks reorganized concepts and attempted to reduce the quantity while improving the quality of what should be taught in science classrooms (AAAS, 1993).

Soon after the Benchmarks, the National Science Education Standards (NRC, 1996) were released as an attempt to standardize *what* was being taught in science classrooms. The writers of the National Science Education Standards (NSES) then published the National Science Inquiry Standards (NRC, 2000) in an attempt to standardize *how* science was being taught. These standards were written at the request of the national government wanting to find ways to measure development of students in science although accountability was never the intended focus of the standards writers. The NSES were meant to provide a common vision for science education and has been described both as “a document of persuasion” (Bianchini & Kelly, p. 386, 2003) and as a “roadmap for teachers” (Johnson, p. 172, 2007). Even without a mandate, the development of national standards has had an impact on science teaching and learning. While a

national curriculum never evolved from these publications as some predicted (DeBoer, 2002), states such as Florida continue to cite the NSES as the inspiration for the creation of their own standards (Florida Department of Education, 2008). Research shows that states have seen the national standards as guidelines rather than mandates (Haury, 2001). The standards are perceived in many states as the ideal, with deviations expected and permitted (Corcoran & Christman, 2002).

Just as the National Science Education Standards (1996) have evolved into state standards, national policies are often adjusted to fit the needs of the individual states. One such program, No Child Left Behind Act (NCLB) defined its purpose as: "to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging state academic achievement standards and state academic assessments" (U.S. Department of Education, 2004). Based on recommendations in NCLB, states created policies for funding, curriculum materials, and accountability (Bianchini & Kelly, 2003). States have historically sought to maintain their autonomy when it comes to education and although NCLB seemed to carry a lot of weight, states found ways to individualize their accountability measures beyond just the standards (Bianchini & Kelly, 2003; Crawford & Tindal, 2006). On every level, these science reform efforts have had a profound effect on education especially limiting how and what teachers feel they can teach (Shaver, et al, 2007).

Despite all the efforts at creating national symmetry in science education, research has found that teachers are typically more familiar with the state created standards than with the original national standards (Smith & Southerland, 2007). Even in a study whose participants were graduates of a reform-based teacher preparation program and who were currently

employed in schools in a state which emphasizes the link between their standards and the national standards, familiarity with the national standards was found to be lower than expected (Marbach-Ad & McGinnis, 2008). The national science standards were disseminated to the states who amend them to retain their autonomy in educational decisions (Haury, 2001). These state standards were then used to create high stakes science assessments in order to establish accountability for what the students know and are able to do. States have made painstaking attempts to assure their districts that the standards do not imply a standardized science curriculum, simply a framework to use to develop their own curriculum (Corcoran & Christman, 2002). The inevitable adjustments had, in some cases, resulted in state standards that were not aligned with the overall vision of science reform intended at the national level (Bianchini & Kelly, 2003).

In early 2008, the state of Florida released its Next Generation Sunshine State Standards (NGSSS) for Science (FLDOE, 2008). Along with the standards themselves, came documentation of the justification of the changes the standards had undergone. The FLDOE purported that the NGSSS for science would allow for better vertical alignment K-12 resulting in a learning progression for the students. This progression would allow prior knowledge to serve as the basis for new learning while constantly striving for a rigorous final set of understandings. Unlike the previous set of science standards the state had released, the NGSSS sought to encourage curriculum designers and teachers to organize concepts under interconnected ideas rather than into discrete science courses. For middle school teachers throughout the state, this meant potentially looking at a more integrated science curriculum than the traditional order in which the subjects were being taught. For example in the school district under study, 6th grade

teachers provide instruction in Earth/Space Science, 7th grade teachers in Life Science, and 8th grade teachers in Physical Science. The NGSSS revised those divisions and focused instead on overarching concepts (Big Ideas) woven throughout science disciplines (FLDOE, 2008).

From extensive research as part of the NSF Local Systemic Initiative, Weiss, et al, (2003) discovered that individual districts vary in their use of the state standards to create their science curriculum. In an effort to create science reform of their own, some districts have reworked the standards dramatically. Other districts have simply reordered the standards to fit the needs of their populations. Although autonomy is still important at the district level, differences are generally much smaller from district to district than from state to state. Once the districts develop their science curriculum, many schools indicate a perception that they are mandated to follow it (Grobe & McCall, 2004). Some schools have found ways to make alterations based on their student distribution, methods that have worked traditionally; administrative discretion, and in response to pressure to perform in low achieving schools (Corcoran & Christman, 2002). Often these changes are minor in states with high stakes science assessments, since each school must ultimately prepare their students for one science standardized test (Crawford & Tindal, 2006). Assessments become drivers of curriculum, encouraging uniformity, but the architects of the science reform often expect too much change in assessment outcomes to happen too quickly and strategies and curricula are abandoned before they are off the ground (Eisenhart, et al, 2001) giving teachers a sense of a constantly changing educational direction.

It has been noticed that with large-scale science reform policies, the classroom teachers have limited input in what the science reform entails until it is given to them to implement (Keys & Bryan, 2001; Smith & Southerland, 2007). Smith and Southerland (2007) reported that

although national science reform efforts are trying to change teacher beliefs using testing, standards, and mandated curriculum, most science reforms do not take into account the needs of the individual classrooms. Their comparative case study of elementary teachers' beliefs as they related to the reform measures they were given was driven by the desire to see the effect of reforms on individuals. According to Keys and Bryan (2001) following their review of literature related to teacher efficacy concerning reform, "when reform efforts are based on documents that represent the intended curriculum of researchers rather than the enacted curriculum of teachers there is a mismatch that impedes science education reform" (p.635). Teachers feel pressured to find a common ground between the depth of knowledge suggested by the standards and the breadth covered in their textbook (van Driel, et al, 2001). Therefore matching what teachers are doing to what the science reform intended is an urgent concern.

Research into the application of science standards and their related instructional materials, resulted in a conclusion that using standards as "instruments of accountability can limit democratic decision making" when science reform is attempted (Bianchini & Kelly, p. 384, 2003). Still attempts have been made to assess progress in science nationally using a standardized, statistically established test based on the standards. In 2006, the National Assessment of Educational Progress (NAEP) released the most recent Report Card on Science (Grigg, Lauko, & Brockway), a compilation of the results of nationally administered assessments which included a science test for grades 4, 8, and 12. Students were randomly chosen throughout the nation to take the assessment and were given a letter explaining the purpose of the exam. The analysis of the nationwide science assessments taken by students in 2005 showed an overall growth in 4th grade scores, a decline in overall 12th grade scores, and no change in overall 8th

grade scores since 2000. Although NAEP is given much attention by policy makers, in states like Florida, this test is usually taken within a few weeks of the states' high stakes assessment so it is unclear what importance the students and teachers give the NAEP test. Additionally, the Report Card on Science (Grigg, et al, 2006) emphasized that with NAEP the students were assessed not just on content but on process, including having some students "undertake actual experiments using materials provided to them..." (p. 3). This assessment tends to have a structure of testing that is very different than many state assessments such as Florida's which focus primarily on factual knowledge which makes the results of state tests and those of NAEP more difficult to compare.

As with these national and state created assessments, the political arena and educational reality are often at odds and perhaps there is no way to create a policy in one that will be fully accepted in the other (Eisenhart, et al, 2001). With a contradiction of purposes, synchronicity has been hard to establish. Consistently researchers (Eisenhart, et al, 2001; Shaver, et al, 2007; Smith and Southerland, 2007) have reported the finding that awareness of teacher beliefs is critical for understanding how policies will be perceived and implemented. However, while congressional mandates related to NCLB and NAEP have attempted to impact what gets taught in science classrooms, research has shown that teachers often were still unaware of the true intent of national science reform efforts because the mandates continued to come from outside of their immediate educational system (Smith & Southerland, 2007). As Hurd (2000) claimed after his analysis of a 50-state survey of secondary school science initiatives: "The introduction and implementation of a new curriculum into schools are difficult processes. A first step is to create a level of awareness in the field in terms of purposes, rationale, and goals" (p.37). Helping

teachers process the true nature of the reform can be assisted through support structures developed as the implementation process begins.

Support during the implementation of reform

Once the reform reaches the district level, fidelity of implementation often depends on factors beyond the individual teachers' control such as accountability measures and professional development offerings. At issue is that there is frequently a disconnect between the reality of the support structures and the teacher perceptions of that support (Lumpe, et al, 2000).

Accountability efforts aimed at standardizing science curricula and professional development focused on explaining the curricular changes have been the focus of studies as a movement toward consistency in science education nationally has gained momentum.

Attaching accountability initiatives to science reform has seen varying success. Current science reforms, such as standardized testing in science and new science standards were generated as a result of NCLB. While substantial time and effort was put into creating the act, funding and support laid out in NCLB was inconsistent (Grobe & McCall, 2004). After researching the concerns of teachers related to accountability in one Florida school district, Pringle and Martin (2005) found that the mandated growth patterns in student achievement had been turned into the sole motivators of curriculum in some schools. Schools had been forced to find ways to meet the requirements of NCLB, find ways around NCLB, or suffer the consequences of NCLB (Crawford & Tindal, 2006). Under NCLB, state assessments were created to meet the accountability standards. Science reform at the state level became not much more than the creation of high stakes tests (Crawford & Tindal, 2006). These assessments sought

to influence instruction and make students and teachers accountable for academic performance (Diamond & Spillane, 2004). This goal was seemingly met but perhaps to the detriment of other types of science reform (i.e. inquiry and student driven instruction).

While initially standards-based science reform may have had improved quality of instruction at its core, the inevitable link to high stakes testing has subverted that goal time and again (Snow-Renner, 2001). Standardized testing results have emerged as the ultimate judge of science reform success or failure. In his comparison of student-centered learning with standards-based teaching, DeBoer (2002) found that standardized testing had the presumably unintended consequence of creating an atmosphere where only what is on the test gets taught. Particularly at the onset of the reform, test expectations focus teacher processing of the curriculum. However these tests do not always reflect the growth of the learning of the student and reflect low expectations for student understanding (Snow-Renner, 2001). A key concern as mentioned previously is the urgency of the accountability system to generate results. Research has shown that it often takes three years of implementation for a standardized test to be considered reliable (Grobe & McCall, 2004) and almost the same three years for teacher beliefs to change (Davis, 2003; Roehrig & Kruse, 2005). Therefore teaching “to the test” often becomes an exercise in trying to hit a moving target.

Results can be observed from similar efforts outside of the state of Florida. Reform policies around the world (ex. Canada, UK, Australia, and Netherlands) have been driven by the common dissatisfaction with the status quo in science education (van Driel, et al, 2001). The imposition of a uniform science curriculum in England, for example, has been reported to limit teacher motivation and reflective discussion (Bianchini & Kelly, 2003). As it began to be

documented in our country that testing was quelling innovative teaching, limiting curriculum, and destroying the joy of learning in students (Haury, 2001), some states and large urban areas took action to avoid similar wide-spread problems while implementing accountability policies. In Philadelphia high standards and strong accountability were chosen as the catalysts for science reforms (Corcoran & Christman, 2002). Money and professional development were provided to teachers to attempt to bring about systemic changes to the way science was being taught. Overall, some gains were made but distinct problems were observed in the secondary schools' attempts to implement science reform. In Vermont, educational leaders tried to thwart the typical standardized testing pitfalls by spending two years developing a meaningful assessment (Daniels, 1997). Their efforts had limited success because, as often happens, the designers failed to maintain realistic expectations for when results should be seen. Similarly, Oregon educational leaders sought to use assessments and accountability to control curriculum (Crawford & Tindal, 2006) but found difficulties when state and local values were not aligned.

On the opposite end of the spectrum, some states chose to avoid high stakes testing and standardized curriculums in favor of greater teacher expectations and support and some of these states: Minnesota, North Dakota, Iowa, Wisconsin, and Maine have shown high student scores on national assessments (Darling-Hammond & Ball, 1999). Some research has shown that these states without high stakes tests had a better instructional balance within all content areas which may have been the impetus for their success (Crawford & Tindal, 2006). It is also possible that their success reflected the fact that the NSES and NAEP focus on processes of science rather than the memorization of scientific fact as opposed to many high stakes state assessments (Haury, 2001). Therefore preparation for state assessments does not necessarily help with

national assessments. In order to assure that the preparation for state assessments would also help with national testing, state standards must be written and implemented to match the content *and* the pedagogy of national science reform efforts (Smith & Southerland, 2007). Even with the best strategy for implementation, external factors can change the course of the reform. In the case of a widespread science reform effort in Philadelphia, for example, "a noble cause, a committed leader, and a grand plan were undone by the failure of the state and city to provide adequate funding" (Corcoran & Christman, p. 33, 2002). Innovations are rendered useless without the support and commitment within the schools (Darling-Hammond & Ball, 1999). So it is important to know how school-level decisions are made in relation to the national and state policies.

Based on survey analysis of the beliefs elementary teachers in a high-needs school district, Snow-Renner (2001) found that individual school district, and school policies toward science reform can result in a wide variety of implementation strategies. School-based adjustments to a policy may ultimately have a more direct affect on the resulting academic improvement than the original initiative itself (Heck, et al, 2001). Effective science reform efforts are often more dependent on local elements than on federal mandates (Smith & Southerland, 2007). Administrators have often said their hands were tied when it comes to educational decision making because so much pressure was being placed from district, state and federal mandates (Grobe & McCall, 2004). District leaders set the priorities for curriculum and created incentive procedures which influenced what schools can and do teach (Weiss, et al 2003). When curricular programs were mandated, and instructional time programmed into school district plans, principals were left without a choice in how instruction will be delivered. For

example, the avoidance of science instruction was exacerbated in many cases with district accountability policies which stressed language arts and mathematics and therefore causing school leaders to focus on those subjects (Spillane, et al 2001). Any inclusion of science in elementary grades often was limited or disjointed. Shaver, et al (2007) in their research found elementary school administrators suggested that science instruction be set aside in order to devote more time to tested subjects like reading and mathematics. Both high and low performing schools have been documented as putting other subjects ahead of science in response to testing requirements (Diamond & Spillane, 2004). Also in their research into elementary leadership support of undervalued subjects Spillane, Diamond, Walker, Halverson, & Jita (2001) reported that without the inclusion of science in state testing, resources and curriculum leaders were disproportionately missing from that content area. Emphasis was placed on mathematics and reading initiatives and specialists since these areas were tested. As science has begun to be incorporated into standardized assessment, the sequestering of science will likely be adjusted.

Crawford and Tindal (2006) stated that accountability requirements have moved responsibility for reform implementation toward schools and away from the states. Districts often define content standards but often do not address or are vague concerning specific expectations for day-to-day instruction (Corcoran & Christman, 2002). With this vagueness, it has been up to the schools to create their own expectations. While administrators have seen the district policies as guidelines, teachers have viewed them as prescriptions (DeBoer, 2002). The disconnect between teachers and administrators has been problematic. Science reform efforts in education must involve all parties working collaboratively within a school building (Johnson, 2007). No matter how much effort goes into policy decisions at the school district, state, and

national level, it is ultimately the individual teachers that determine the implementation of the policies (DeBoer, 2002).

As the researchers have waited for the tests to be established statistically, impatient school-based and state leaders continued to demand results (Eisenhart, et al, 2001). The administrators were not always to blame for their lack of patience with assessment results though. These school leaders knew that the national funding sources were frequently most interested in how many teachers were implementing the science reform and how fast the dissemination was happening (Craig, 2006). States have had significant influence over their respective schools, sometimes using accountability measures or funding as a motivational tool as mandated in NCLB (U.S. Department of Education, 2004). Asking the teachers themselves how they feel about science reform is a different variable than the reports of student achievement from assessments (Schneider, et al, 2005). In order to provide the support for the teachers undergoing the science reform, more than test scores are needed. The one size fits all strategy of accountability within science reform efforts has been shown to be the undoing of widespread improvement.

While accountability measures have often been perceived in a negative light by teachers, professional development were usually viewed as positive support for reform. Ultimately reform, no matter how well designed in the absence of professional development was not enough to facilitate change (Metz, 2009). In their assessment of the NSF Urban Systemic Initiative, Kim, et al (2001) found that in every school, professional development was recognized as a major factor in the success of school science reform. As with accountability, professional development as a means for supporting science reform has a wide spread research base. Roehrig and Kruse

(2005) found in their study of teacher implementation of high school science curriculum initiatives that reforms required comprehensive professional development in order to be successful. They clarified their findings by stating that the support needs to be “intensive one-on-one professional development over an extended time period” (p. 413). King, et al (2001), also stressed the need for effective staff development programs, particularly in urban school settings after conducting an in-depth case study of science teaching in an urban elementary school. Lumpe, et al (2000) caution that “...discussions must go far beyond pep talks about the potential for reform. Teachers should be provided with frequent opportunities to identify their beliefs, reflect on the current status of the responsiveness of their school environment, and create a dialogue with administrators and local school community members about these issues” (p. 288). Because science reform often involves significant changes in teacher belief systems, the existing beliefs of teachers must be taken into account within the professional development (Roehrig & Kruse, 2005).

Following the analysis of the implementation of a middle school science initiative Davis (2003) suggested that since the process of change may take several years, support should take the form of staff development, teacher teams, coursework, and peer-coaching not just a one-time professional development session. In the Urban Systemic Initiative in Detroit, professional development included week-long summer institutes, online resources, and teacher discussion groups (Geier, Blumenfeld, Marx, Krajcik, Fishman, Soloway, & Clay-Chambers, 2008). Allowing the teachers to work in a collaborative environment, constructing their own knowledge just as they would have the students do, has resulted in a deeper understanding of the science reform policy and its implications (Davis, 2003; Radford, 1998). Radford (1998) also found,

through the analysis of the effectiveness of a large scale, NSF funded professional development in Louisiana, several other factors which were important for effective professional development: Opportunities for reflection and feedback, understanding budget realities, and integration of science content, process skills, and pedagogy.

Specializing professional development to meet the needs of the teachers is important as Kim, et al (2001) found that elementary teachers participated in far less professional development than their middle school counterparts. Professional development programs therefore should begin where the teachers are and then lead them to a common understanding of meaningful content and pedagogical best practices. To avoid the failure of a reform at its early, mechanical use, support must be provided and would best be formatted in a social environment (Gess-Newsome, et al, 2009). Teachers need to be supported through the often inevitable initial slump in performance and look for long term outcomes. In their extensive research of literature describing past reform efforts, van Driel, et al (2001) found that traditionally, failure had been blamed on the teachers' inability to implement the intentions of the reform developers. Professional development, if done correctly could bridge the gap between intention and implementation.

In light of all the understanding of the development of science reforms, the support for the reform in the form of accountability and professional development, and the various factors affecting teacher beliefs such as achievement history and socioeconomic status of their students, it would seem science reforms should be largely successful but some studies continue to suggest otherwise. Eisenhart, et al (2001) claimed that "educational policies that are incompatible with teacher beliefs are not implemented as intended; teachers may behave, purposefully or

unconsciously, in ways that alter or undermine the programs proposed by policy makers" (p.137). Rather than achieving standardization, science reform efforts have been found in some cases to narrow science curriculum as teachers believe they must teach only what is tested (DeBoer, 2002; Diamond & Spillane, 2004; Pringle & Martin 2005). Conversely, other teachers have reported that they do not feel the tests are accurate representations of what their students know, so they ignore the pressures (Crawford & Tindal, 2006). Some research-based aspects of science education, such as inquiry and cooperative learning, have become endangered pedagogical species as a result of recent high stakes science reform efforts (DeBoer, 2002; Pringle & Martin, 2005; Shaver, et al 2007; Weiss, et al 2003). In an age of accountability, drill and practice may be an easier pedagogical choice when performance on an assessment heavy on rote memory is important (Johnson, 2007).

School-based influences after implementation of reform

Despite the support (and/or pressure depending on the perspective) from district and state agencies, research has shown that school-based factors often have had the greatest influence over what happens inside the classrooms (Snider and Roehl, 2007). How schools interpret a high stakes environment has determined the true effect of science reform efforts (Diamond & Spillane, 2004). Several characteristics of the school have been reported to play a role in implementation. Davis (2003) found that the structure, socio-cultural context, and political dynamics of the school worked against science reform efforts. Snider and Roehl (2007) also found that similar contextual factors created a complex environment for science reform in a school. The political structure within a school often includes a disparity between the beliefs of

administrators and teachers. Because principals have reported feeling that the results of standardized testing as a useful tool for school accountability, more so than teachers (Crawford & Tindal, 2006), belief in the test results has caused principals to make curricular decisions meant primarily to have students perform well on the tests. Citing extensive research-based findings, Eisenhart, et al, (2001) reminded leaders that the best assessment decisions are not always applicable district-wide. Inappropriate reactions to the policies have resulted at times in poor pedagogical practices and a limited curriculum (Grobe & McCall, 2004).

Research has presented many arguments as to the identities of the school based influences on teacher beliefs concerning science reform policies (Corcoran & Christman, 2002; Smith & Southerland, 2007; Snow-Renner, 2001). Three of these influences: grade level, achievement history, and socioeconomic status are highlighted here and were explored further through the results of this study. Differences have been observed in the outcomes of science reform efforts between elementary and secondary schools (Corcoran & Christman, 2002) so it was postulated that the beliefs of those teachers in different grade levels were somehow different as well. Socioeconomic status has been found repeatedly to have an effect on science policy implementation and interpretation (Davis, 2003; King, et al, 2001; Schneider, et al, 2005; Snow-Renner, 2001) so analysis based on SES level sought to see whether this particular school district also varied in beliefs toward science reform due to this factor. Similarly, differences have been documented between the results of science reforms in low and high achieving schools (Smith & Southerland, 2007). Snow-Renner (2001) found that in low performing schools, the pressure to bring up test scores led to narrowing of the curriculum and lower learning expectations.

Therefore it was hypothesized that the teachers within those schools of differing achievement histories believed differently about the policies they were asked to enact.

The theory of differences in science teacher beliefs based on grade level, had its roots in several studies (Corcoran & Christman, 2002; Davis, 2003; Kim, et al, 2001; Snider & Roehl, 2007). Teacher perception of their decision-making abilities concerning science reform has been shown to relate to their perceived status in education (Davis, 2003). Typically, secondary teachers have been found to have a higher status than elementary teachers when it comes to content expertise thus potentially creating differing teacher responses to reform depending on the grade level they teach. Similarly, Kim, et al (2001) found that 40% of middle school science teachers in their Urban Systemic Initiative research had majored in science in college compared to only 5% of elementary teachers, leading them to assume content knowledge may have affected the elementary teachers' ability to participate in science reform activities. In their multi-state study of a science reform initiative in the upper Midwest, Snider and Roehl (2007) found significant differences in the beliefs of elementary and secondary teachers concerning issues such as learning styles and whether all children can learn basic mathematics and reading skills. Corcoran and Christman (2002) studied reform in Philadelphia and found a uniform policy of support across grade levels was not effective. Once supports in that district were customized, for elementary schools in particular, the reform's success increased. The results of these studies suggest that the beliefs of teachers concerning science reform can differ based on the grade level for which the teacher is responsible.

The second school-based factor under consideration was the socioeconomic status of the school in which the teachers work. In studies which considered school poverty (Davis, 2003;

King, et al, 2001; Schneider, et al, 2005; Snow-Renner, 2001), it was found that the interpretation of standards and science reform policies based on those standards were often related to the school's socioeconomic status. Teachers in schools serving poor students, tended to overemphasize memorizing facts and teaching to the test while the national science standards emphasized inquiry-based approach (Davis, 2003; King et al, 2001). Snow-Renner (2001) found socioeconomic status to be a significant factor in teacher beliefs toward testing. The teachers in affluent schools in the Snow-Renner study looked more negatively at test-driven instruction than their counterparts regardless of their achievement history on those tests. The particular challenges faced by schools with high poverty may therefore have influenced how teachers perceived science reform. "In urban settings, teachers are not only challenged by the complexity of reform based teaching, but also by the complexity of the context in which they are teaching" (Schneider, et al, p. 285, 2005). Some of these challenges are lack of resources, low student achievement, and difficulty hiring and keeping quality teachers (Geier, et al, 2008).

Despite Snow-Renner's (2001) findings that for some teacher beliefs, socioeconomic status overrides achievement history, other studies (Geier, et al, 2008; Prime and Miranda, 2006; Roehrig, Kruse, and Kern, 2007; Snider & Roehl, 2007) have found that the school's achievement history is indeed a school-based factor which may influence teacher beliefs toward science reform. In an atmosphere of accountability, all teachers are responsible for the achievement of their students particularly those in high risk groups (Snider & Roehl, 2007). To comply with this, science reform efforts need to prove that they will result in measureable achievement gains (Geier, et al, 2008). In a study of science teachers in an urban setting, Prime and Miranda (2006) found differences in teacher beliefs among low and high achieving schools.

The teachers in low-achieving schools in the study felt their students lacked the prior knowledge they would need to be successful in the science curriculum. While the teachers in high performing schools worried that their kids were not challenged enough by the science curriculum. Roehrig, Kruse, and Kern (2007) found similar results when they studied the implementation of a Chemistry curriculum in an urban district. The schools which had met the state academic goals were looking for ways to increase the rigor of the curriculum and several were even in the midst of initiating additional reform attempts.

To compound the difficulty of reform implementation, it has been found that what teachers say about their use of the reform and what they are actually doing are at times at odds. When science teachers attempted to implement the science reform as intended and report doing so, careful examination showed instruction often missed the original intention of the policy (Smith & Southerland, 2007). Although Schneider, et al (2005), suggested after their work with middle school teachers under the Urban Systemic Initiative that making adjustments to a particular pedagogy did not necessarily result in a distancing from the overall intention of a science reform therefore discrepancies in instruction may be acceptable. However, Snider and Roehl (2007) suggested that empirically based changes teachers made to science reform policies did not align with the scientifically based methodologies suggested in the latest science reforms. They also found that, particularly in struggling schools, the implementation of science reform in individual pieces rather than as a comprehensive whole made the reform less successful. Since the issue of science reform acceptance appears to be unique to each district and seemingly to each school, an in-depth look at teacher beliefs may assist the school district under study here in avoiding the weaknesses while building on the successes of other similar reform efforts. The

district hoped to go beyond using teachers as simply the “(executers) of the innovative ideas of others” (van Driel, et al, p. 140, 2001) to allowing them to be innovators themselves.

In summary of Chapter Two, research has shown that as reforms are developed there can be conflict between the goals of the designers (often politicians) and the interpretations of the end users (teachers). Also that there exists a catch-22 of sorts between reform and teacher beliefs in that reforms often attempt to alter teacher beliefs while teacher beliefs frequently affect how reforms are implemented. Finally, research suggests that professional development efforts need to be designed based on what teachers believe about the reform and how it fits into their existing feelings about what works in education. In Chapter Three, the methods used to determine the beliefs concerning the science reform of the teachers who participated in this study are presented including the experimental design, instruments, and analysis procedures. Also included in the next chapter are the assumptions and limitations which frame this study.

CHAPTER THREE: METHODS

The basis for this study was a desire to understand science teachers' beliefs concerning a science reform effort: the upcoming transition to the Next Generation Standards. In this chapter, the experimental design employed during data collection was presented. Following the design, a description of the instruments and analysis procedures were provided along with an explanation of the assumptions and limitations which exist in this study.

Experimental Design

The experimental design was a mixed methodology using both the Likert and open-ended survey responses for the teachers who chose to participate. The initial data analysis was quantitative using the responses to a Likert scale instrument (SoCQ). There were three statistical tests employed to compare the data. Differences in peak SoCQ score for Elementary vs Middle school teachers were analyzed using an Independent t test. The Independent t test determines the differences in the scores of 2 unrelated groups which made it appropriate for the first comparison. Differences in peak SoCQ score for teachers based on the SES of their school and differences in peak SoCQ score for teachers based on the achievement history of their school were analyzed using the ANOVA procedure. ANOVA tests determine differences of scores among multiple groups which made it appropriate for the second and third comparisons. All tests used a p value of .05 for significance testing.

Following the quantitative analysis, a series of comparisons were conducted using the teacher responses to several open-ended items. This qualitative analysis served to delineate the teachers' beliefs more specifically and compare groups in more detail based on the identified factors that may affect those beliefs. These items were developed by the researcher after analysis

of the original instrument to gather more detailed responses from teachers relating to their concerns over the science reform. As stated within the instrument document, these types of “open-ended statements provide valuable context for interpretation of the SoCQ profile(s)” (George, et al, 2006, p. 25).

Population

The population for this study was all 3rd through 8th grade public school teachers (approximately 640) within one urban school district in Central Florida who taught science at least part of their school day. The school district selected, consisted of approximately 65,000 students and 4,600 teachers in grades K-12. Overall 32% of the district’s students were on free or reduced lunch. Approximately 14% of the total population was African-American, 18% Hispanic, and 59% Caucasian. The district’s FCAT Science scores had been in the Top 10 for counties in the state of Florida for the previous two years. The district’s graduation rate had consistently been over 85%.

At the time of survey distribution, both elementary and middle school science teachers were following a curriculum based on the Sunshine State Standards written in 1996. With the implementation of the 2008 NGSSS, the elementary teachers would see a marked increase in the depth of their required content as well as a more clearly defined learning progression. Middle school teachers would teach more in-depth science content along with the potential for a more integrated curriculum which would seek to build upon previous concepts taught as students progressed through middle school (FLDOE, 2008).

There were two specialists at the school district office to support elementary and middle school science teachers. The elementary specialist also assisted with mathematics curriculum and conducted monthly meetings with representatives from the 37 elementary schools in the district to disseminate mathematics and science information and work on best practices. Elementary curriculum writing traditionally had been done by a small number of purposely selected teachers and administrators and supervised by the district specialist who then disseminated the final product through professional development at each school. The secondary specialist facilitated just science teachers and had monthly meetings with the science department chairs from each of the 12 middle schools to discuss relevant information and instructional strategies. Middle school curriculum writing had typically been accomplished by bringing together teacher volunteers from each school with assistance in the development provided by the district specialist. Upon completion of the writing, each representative was charged with the task of explaining the new curriculum to their peers in each school.

Instruments

The instrument used for primary quantitative data collection was the SoCQ published by George et, al (2006). Permission to use the survey was solicited and granted from SEDL prior to its distribution (APPENDIX D). The SoCQ had been used frequently over the last few decades both in and outside of education to determine where participants fell within seven stages of concern in relation to a given innovation. The stages (Figure 2, full version in APPENDIX B) range from "0" (Unconcerned) and to "6" (Refocusing). Knowing where teacher concerns were

within this framework is important when working through a change process because earlier concerns ("Self") must first be resolved before later concerns ("Impact") can emerge (George, et al, 2006).

Table 1: Typical Expressions of Concern about an Innovation (George, et al, 2006, p. 4)

Stages of Concern	Expressions of Concern
Impact (6-4)	6 I have some ideas about something that would work even better
	5 I would like to coordinate my effort with others, to maximize the innovation's effect.
Task (3)	4 How is my use affecting my students?
	3 I seem to be spending all my time getting materials ready.
Self (2-1)	2 How will using it affect me?
	1 I would like to know more about it.
Unconcerned (0)	0 I am not concerned about it.

As described by George, et al (2006), in order to maintain the integrity of the SoCQ, only the word "innovation" was replaced in the individual survey items. In the survey questions used in this study (APPENDIX A) "innovation" was replaced with "science reform." In addition, the phrase "science reform" was defined on the survey for the participants. With no other changes, the established validity and reliability of the instrument was assured with its use in the current research. The SoCQ was previously used in eleven educational studies over the course of two years to determine validity by seeing how consistently responses fell within the stages. Researchers also interviewed respondents and compared the transcribed responses to the ratings on the SoCQ. Using Factor Analysis of the items during a pilot administration, strong correlations (> .65) were found between each stage and identified factors. Since the initial

validity was established, internal reliability had been repeatedly confirmed with additional studies over the past three decades that have used the survey for multiple purposes (pp 20-22) and the values ranged from .50 - .86 for correlations between items within the same stage. It was suggested that there will always be some variability in internal reliability as there is no singular intended population for which this survey was designed (George, et al, 2006).

Survey Distribution

At the outset of the study development, consent to initiate the research was obtained from the University of Central Florida IRB committee (APPENDIX D). As part of the university's IRB requirements, the school district's IRB committee was contacted to request permission to administer the survey to their teachers. A summary of the objectives of the study as well as research protocols were provided to the district. The permission gained from the district (APPENDIX D) was then provided to the UCF IRB. As per the district's IRB procedures, principals in the relevant schools were notified of the purpose of the survey and the extent of the requirements of the participation of their teachers. The population included representation from each subgroup: elementary teachers and middle school teachers, schools that performed at varying levels on the 2008 Science FCAT, and schools with varying levels of students on free or reduced lunch, so that meaningful statistical analysis was possible.

The SoCQ along with the four short-response items were sent via USPS mail to the approximately 640 teachers in the population at their schools via their department chairs (middle school) or team leaders (elementary school). Included with the survey was a Consent Letter explaining the intent of the research and a return envelope. The teachers were asked to complete

the survey including the open-ended items and return it in the envelope provided. As the surveys were returned, they were assigned a number for use during further analysis. After two weeks, a reminder email was sent to all of the teachers asking that those who had not yet responded, to please do so. After two more weeks, a reminder email with a second copy of the survey attached was sent out to all of the teachers. In the case of both reminders, teachers who had already responded to the survey were asked to disregard the previously sent email as there was no way to predetermine who needed the reminders.

Analysis Procedures

Efforts to collect the surveys were completed by May 2009 so that analysis could be done. In total, 143 surveys were returned (representing 22.3% of the estimated 640 total teachers). The low return rate could be explained with a few considerations. Because of the parameters of the district's IRB as well as the permission granted from SEDL, the survey had to be completed and returned on paper rather than electronically. This may have reduced the response rate as many educators have become use to electronic communication to simplify their workload and are less apt to complete paper documents. Also the elementary school teacher response rate (15.7%) was much lower than the middle school teacher response rate (54.6%) bringing down the overall rate. The elementary teachers may have been more hesitant to respond to the survey either because their education focus was not entirely on science due to their need to teach all subjects, or possibly because they were less familiar with the researcher than the middle school teachers. Many of the middle school teachers knew the researcher professionally.

While George, et al (2006) suggested that just a few of the surveys should be hand scored using the Quick Scoring Device (p. 86) in order to ensure a thorough analysis of survey results *all* of the surveys were hand scored (see APPENDIX C for an example). The responses were then entered into the survey scoring program provided with the SoCQ in preparation for computer analysis. This initial survey analysis resulted in an identification of each teacher's profile within the Stages of Concern. It was recommended by George, et al, that the raw totals for each stage be used in any statistical analysis as well as the participants' peak score (the Stage of Concern which had the highest score based on the survey responses), so all of this information was entered into the SPSS program for quantitative analysis (see APPENDIX C for a sample of the hand scored survey results for one participant and the determination of the peak Stage of Concern for that participant).

Once all of the teachers' Stage of Concern scores were entered into SPSS along with their grade level and school identifiers, an Independent t (elementary vs middle school teachers) and two ANOVA tests (one based on FCAT scores, the second based on SES percentages) were conducted to determine whether there was a difference in teacher beliefs based on the identified variables. Beyond establishing whether differences existed between groups in relation to their SoCQ scores, it was determined that disaggregated data would reveal a clearer picture of the concerns of teachers in grades 3-8 as they relate to the Next Generation Standards. In an effort to facilitate a deeper understanding of the SoCQ results, George, et al (2006) provided guidelines for interpreting the high and low stage scores. Based on the definitions of the Stages themselves (see APPENDIX B), these guidelines provided a more detailed look at what a teacher with a particular SoCQ score may believe concerning the innovation being investigated. The authors

cautioned however: “The interpretations are only as good as the measure, the genuineness of the participants’ responses, and the skill of the interpreter. Therefore, all interpretations must be treated as hypotheses to be confirmed by the respondents...” (p. 31). While direct confirmation through discussion of the results with the teachers was impossible due to the anonymity of the surveys, the open-ended items were used to generate support for or against the hypothesized interpretations. It is important to mention again that not every teacher who participated in the survey completed the open ended items and this was noted in each case during analysis.

As part of establishing a congruence between what SoCQ scores typically mean for teacher beliefs and the actual teacher responses to the open-ended items, several assertions emerged from an analysis of the open-ended responses. In order to clearly define the assertions, a series of categorical divisions were created. Initially, a determination of whether a teachers’ response was positive or negative toward the reform seemed to be the most obvious categorization. Using the open-ended questions it was possible to establish whether a teacher who fell within a high Stage of Concern did so because they saw the value in the reform for student learning and wished to develop it further or because they wanted to avoid the reform and move on to something else entirely. In order to extend the understanding of the potential differences, these positive or negative beliefs were compared based on the identified factors.

While attempting to categorize the responses into positive or negative values, it became clear that there were several responses which could not be place in either category because the teacher responded to multiple open-ended items indicating that they didn’t know anything about the new standards. Therefore an adjustment was made (based on the peak SoCQ scores) to first separate those who had a grasp of what the reform would require of them and their students from

those who had little or no knowledge of the reform. Only those with a sufficient understanding of the impending changes were then divided according to their positive or negative feelings toward those changes and by whether their concerns related more to themselves as teachers, the students, or the school as a whole.

Assumptions

The primary assumption was that teachers in the school district under study would have at least some working knowledge of the NGSSS and the implications of their use in the curricula in the near future. Since both the school district office and state DOE have sent out information regarding the NGSSS, this assumption should have been valid.

As with any survey, an assumption had to be made that the teachers' responses truthfully and accurately reflect their beliefs. Studying beliefs can present unique problems as they cannot be directly observed and teachers may feel unwilling or unable to express their beliefs fully with those outside of their comfort zone (Marbach-Ad & McGinnis, 2008). The assured anonymity of the survey responses should have assisted with their sense of security in sharing their feelings. The specificity of the open-ended items were intended to help the teachers focus their responses on their beliefs.

Finally, while the decision to go with a more integrated curriculum for middle schools in the school district (i.e. following the FLDOE order of benchmarks) was not decided at the time of the survey distribution, teachers were asked to respond as if that was the case. It was explained to the participants in the consent document that this was to get their reaction to the largest aspect of the reform (redistribution of content) rather than smaller issues such as wording

of individual benchmarks. It was assumed that by doing so, a clearer picture of the teachers' reactions to reform was developed.

Limitations

One limitation of the study was that most, but not all, of the teachers in the school district under study had received at least preliminary exposure to the NGSSS from school district personnel. Some teachers participated in whole or half day school-based workshops; others were part of science leadership teams which discussed the transition to the new standards extensively. This may have potentially altered their beliefs about the reform in ways different from their peers who had not had these opportunities. Because the surveys were returned anonymously, there was no way to separate out the individual teachers who had participated in the leadership teams.

A second limitation affected the comparison between elementary schools and middle schools. While both levels would see some degree of reform when the NGSSS were implemented, the change in curriculum for middle school teachers would inherently be much more significant based on the integrated nature of the new standards. Therefore, it was possible that any difference in the beliefs of teachers based on grade level could have been attributed to the difference in the expectation of change rather than an issue of natural grade level discrepancies. Minimizing this limitation was the fact that all grade levels involved were aware that curriculum re-writes would be involved in implementation of the NGSSS, so reform was inevitable in both cases.

A third limitation was that not all of the teachers who responded to the Likert portion of the survey, also completed the open ended response items. Ultimately six middle school teachers (10.2%) and 19 elementary teachers (22.6%) left the open ended items blank. The effect of

missing responses was to limit the ability to make comparisons between the categories of concern as described by George, et al (2006) and the actual teacher responses, so a detailed description those particular teacher's beliefs was not possible.

Chapter Three presented the methods used during this research in order to determine the beliefs of the teachers in this district concerning the transition to the Next Generation Standards in science. Descriptions of the instruments used explained their purpose in data collection. The inclusion of the analysis procedures clarified which statistical tests were used to compare teachers' responses. Chapter Four will continue by presenting the results of the analysis both quantitatively and qualitatively. The next chapter will also present the breakdown of the responses in terms of the assertions and categorical divisions in order to address the factors of comparison within the research questions: grade level, SES and testing performance.

CHAPTER FOUR: DATA ANALYSIS

The overarching goal of this study was to analyze the factors that potentially influenced teachers' beliefs concerning science reform so that district support could be designed with knowledge of their possible effects. The factors that were the focus of this study were grade level teachers taught, socioeconomic status of the school in which the teacher worked (measured by the percentage of students on free or reduced lunch), and assessment performance history of the school at which the teacher taught (measured by the percentage of students who scored Level 3 or above on the 2008 Science FCAT). Since the reform in question was the transition to the Next Generation Standards in science and the inevitable adjustment in pedagogy and content, the responses of the participating teachers were focused on this innovation.

As suggested by the creators of the initial SoCQ instrument, the participants' peak scores (Stage of Concern for which they responded most strongly) were used during the analysis. This chapter presents the analysis of the data collected from the participants. The mixed methodology data analysis began with quantitative tests which were conducted to determine whether differences existed based on the factors stated above. Once the differences were confirmed, detailed qualitative analysis followed which delved into the nature of the differences. In this chapter the four assertions and categorical divisions are illuminated by the likert-scale item results and sample responses from the open-ended items. One limitation to all of the data analysis presented is the low elementary response rate (15.7%) compared to the middle school response rate (54.6%) which may have affected the observed differences in beliefs just by nature of the sample size.

Quantitative Analysis

The first hypothesis tested was: Elementary (grades 3-5) science teacher beliefs concerning the science reform policy will differ from middle school (grades 6-8) science teacher beliefs. To examine whether the data supported this hypothesis, an Independent-t test was used to compare the peak SoCQ scores for teachers within the two groups. The test indicated that there was indeed a statistically significant difference ($F = 4.466$, $df = 1$, $p < .05$) in the beliefs of elementary and middle school teachers concerning science reform policies. The average peak SoCQ score for the entire group of participating teachers was 2.84 ($SD = 1.83$, $n = 143$).

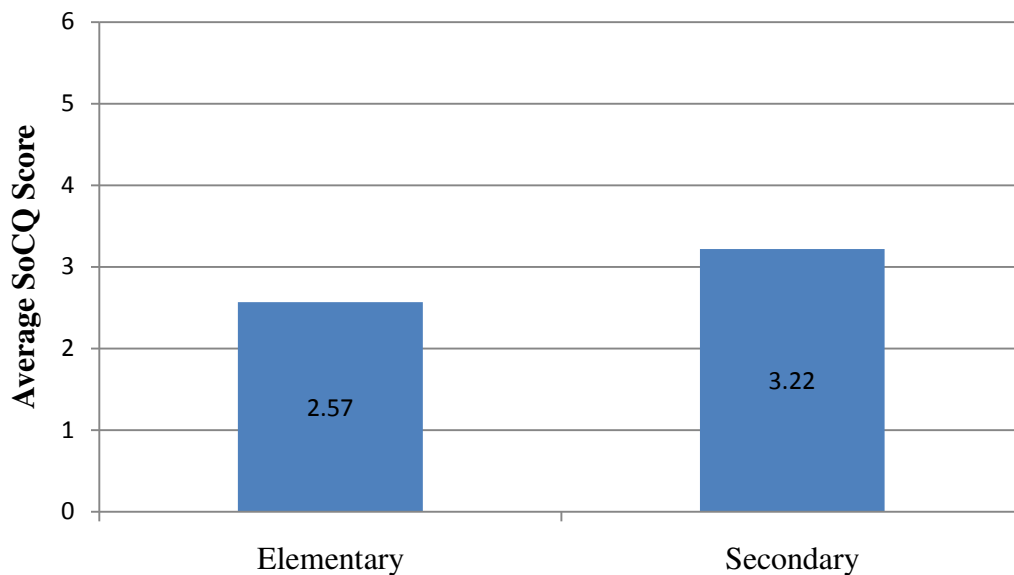


Figure 2: SoCQ scores by Grade Level

As shown in Figure 2, the eighty-four participating elementary school teachers had an average peak SoCQ score of 2.57. Using the descriptions provided by George, et al (2006, p. 53)

a score of this value puts the elementary school teachers between intense personal concerns about the reform (Stage 2) and concerns about management of the reform (Stage 3). The fifty-nine middle school teachers who responded, had an average peak SoCQ score of 3.22 (Figure 2). Once again using the descriptions provided by George, et al, this puts their beliefs about the science reform between concerns about managing the reform (Stage 3) and concerns about how the reform will affect students. Because the peak SoCQ score does not describe the specific nature of the beliefs of teachers, the differences between the two grade level groups were delineated further in the qualitative analysis.

In addition to differences based on grade level, a second research hypothesis was: Science teachers in schools with fewer students on free or reduced lunch will have different beliefs about science reform than those in schools with more students on free or reduced lunch. To test this hypothesis, an ANOVA procedure was used. As a result, there was found to be a statistically significant difference ($F = 1.65$, $df = 27$, $p < .05$) in the teachers' peak SoCQ score based on the percentage of students in their school who were on free or reduced lunch. The mean percentage of students on free and reduced lunch for the entire group was 36.9% with a range from 8% to 77%. In order to visualize the data more readily, after running the ANOVA schools were grouped based on their SES (Table 2). It was thought that if the groups had distinct beliefs about the reform, future support for the reform could be tailored to groups of schools rather than individual schools.

Table 2: SoCQ Participants grouped by SES

Percentage of Students on Free or reduced Lunch	Number of Participants
8-25%	38
26-33%	34
34-46%	37
47-77%	34

Teachers at schools with between 26-33% of their students on free or reduced lunch had the highest SoCQ score (score = 3.05, n = 34), while teachers at schools with between 34-46% of their students on free or reduced lunch had the lowest SoCQ score (score = 2.53, n = 37). As shown in Figure 3 below, when the schools were grouped by SES, although there were distinct differences between the groups, there was no clear relationship between free or reduced lunch percentage and SoCQ score, therefore each school was looked at individually to more closely match the ANOVA procedure.

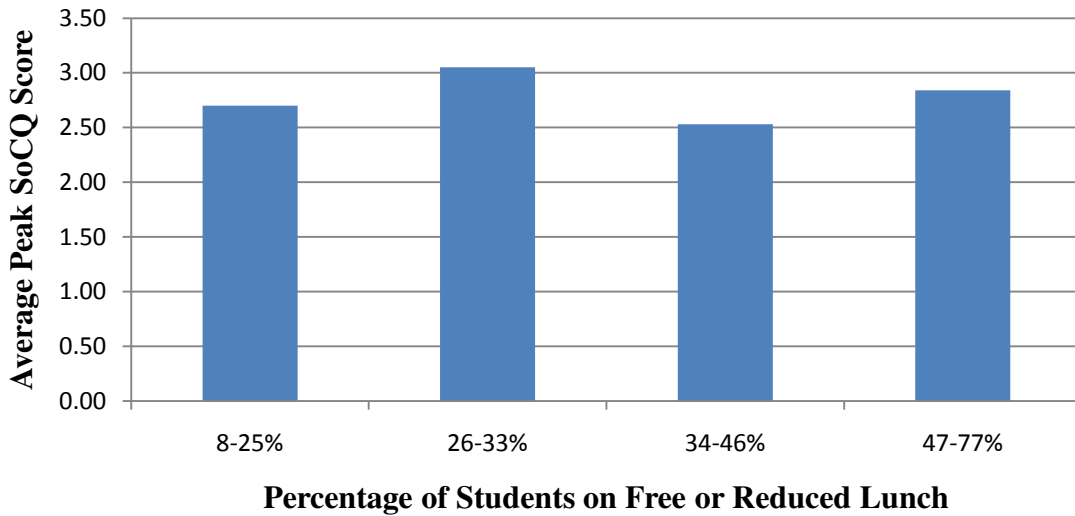


Figure 3: Average School SoCQ Score based on grouped Free or reduced Lunch Percentage

Returning to the analysis individually by school (Figure 4), the overall trend in teacher beliefs about the reform becomes clearer. As the trend line in Figure 4 illustrates, the general tendency was for the average peak SoCQ score of the teachers to move closer to Stage 3 (Management) and further from Stage 2 (Personal) as the free or reduced lunch percentage of the school increased. Beyond the trend, the graph shows tremendous variability between teachers at schools with similar socioeconomic status. For example, the teachers at the school with 44% of its students on free or reduced lunch averaged 4.5 as their peak score, while the teachers at the school with 45% of its students on free or reduced lunch averaged 0.67 as their peak score.

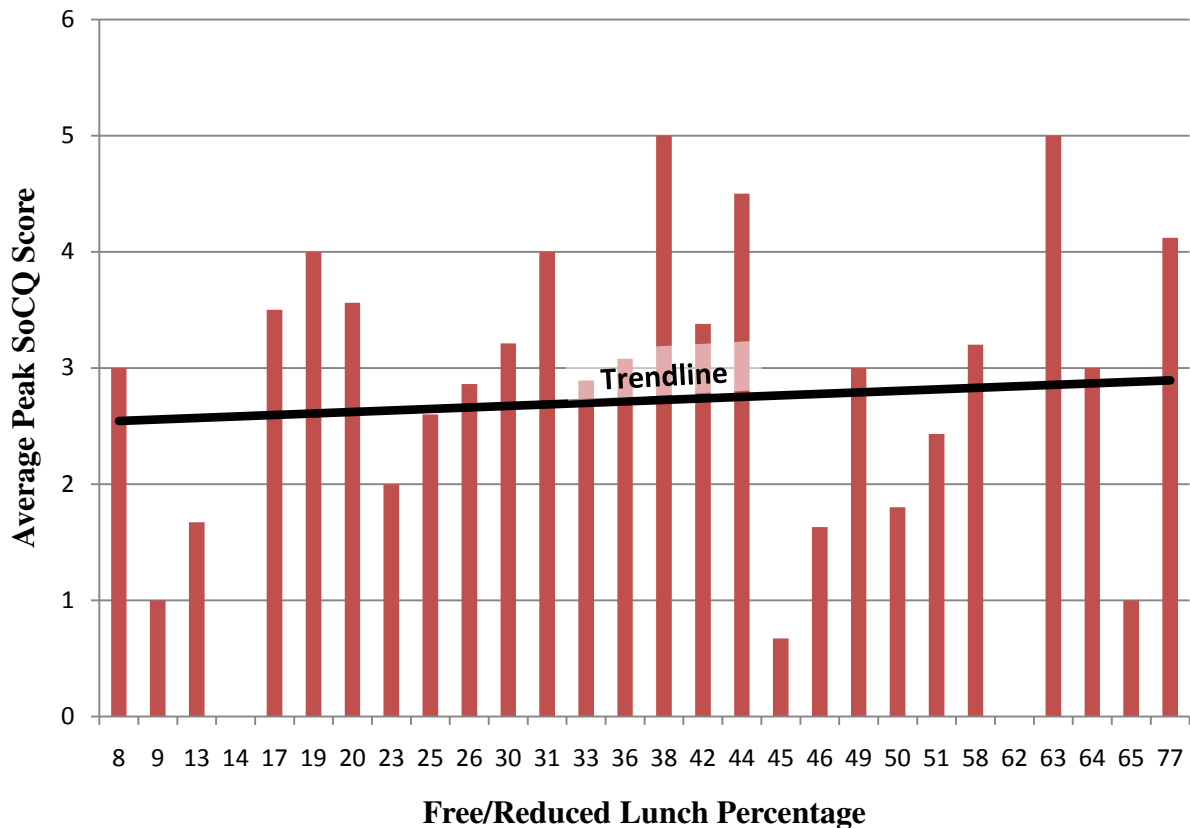


Figure 4: Individual School SoCQ Score based on Free or reduced Lunch Percentage

A final research hypothesis was: Science teachers in schools with more students who scored Level 3 or higher on the 2008 FCAT Science will have different beliefs about science reform than those in schools with fewer students who scored Level 3 or higher. To test this hypothesis, an ANOVA procedure was once again used. As a result, there was found to be a statistically significant difference ($F = 1.70$, $df = 23$, $p < .05$) in the teachers' peak SoCQ score based on the percentage of students who scored Level 3 or higher on the 2008 FCAT Science. The mean percentage of students scoring Level 3 or higher for the entire group was 54.6% with a range from 23% to 78%. Once again, categorizing the schools into four groups (Table 3) allowed for a quick view of the data, but did not reveal a particular trend.

Table 3: SoCQ Participants grouped by 2008 FCAT Science Scores

Percentage of Students who scored Level 3 or higher	Number of Participants
17-44%	38
45-55%	36
56-64%	39
65-78%	30

The group with the highest peak score (score = 3.11, $n = 36$) were teachers at schools with 45-55% of their students having scored Level 3 or higher on the FCAT Science (Figure 5). The lowest peak scores (score = 2.46, $n = 39$) came from teachers who work at schools with 56-64% of their students having received a Level 3 or higher.

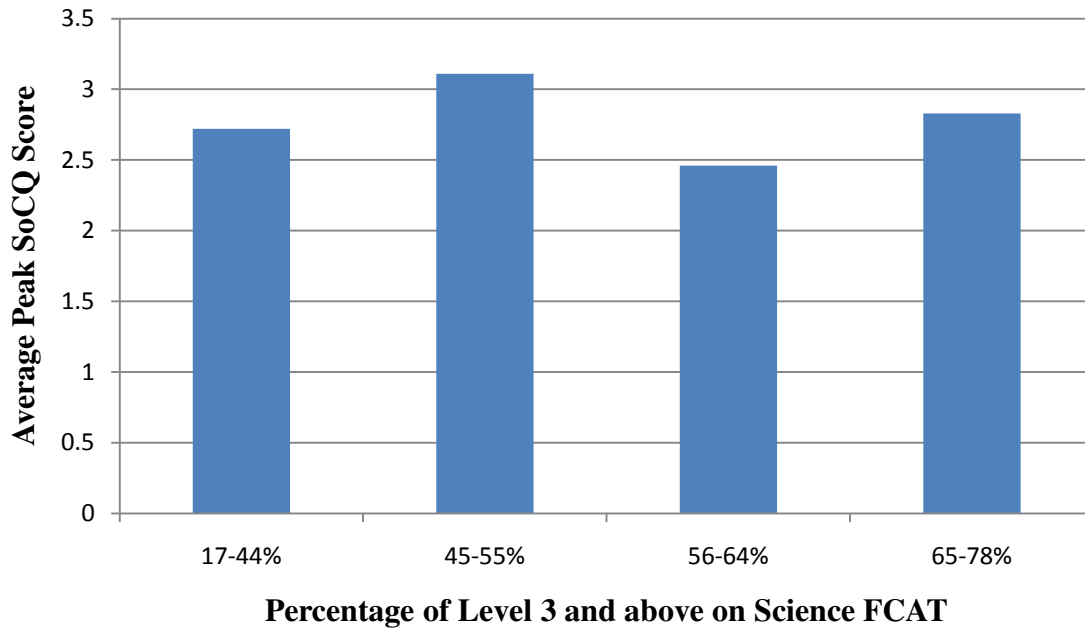


Figure 5: Average School SoCQ Score based on Grouped FCAT Science Level 3+ Percentages

As with the SES data, the scores based on FCAT results were broken back into individual school results, yielding a clearer picture of the overall trend (Figure 6). The variability in peak scores between teachers in schools with similar FCAT results, was reminiscent of the variability when the scores were compared by SES. For example, teachers at the school which had 61% of its students score Level 3 or higher on the 2008 FCAT Science had an average SoCQ peak score of 4, while their peers at the school which had 62% of its students score Level 3 or higher had an average SoCQ peak score of 1.2, suggesting differences in the beliefs of these teachers toward the reform.

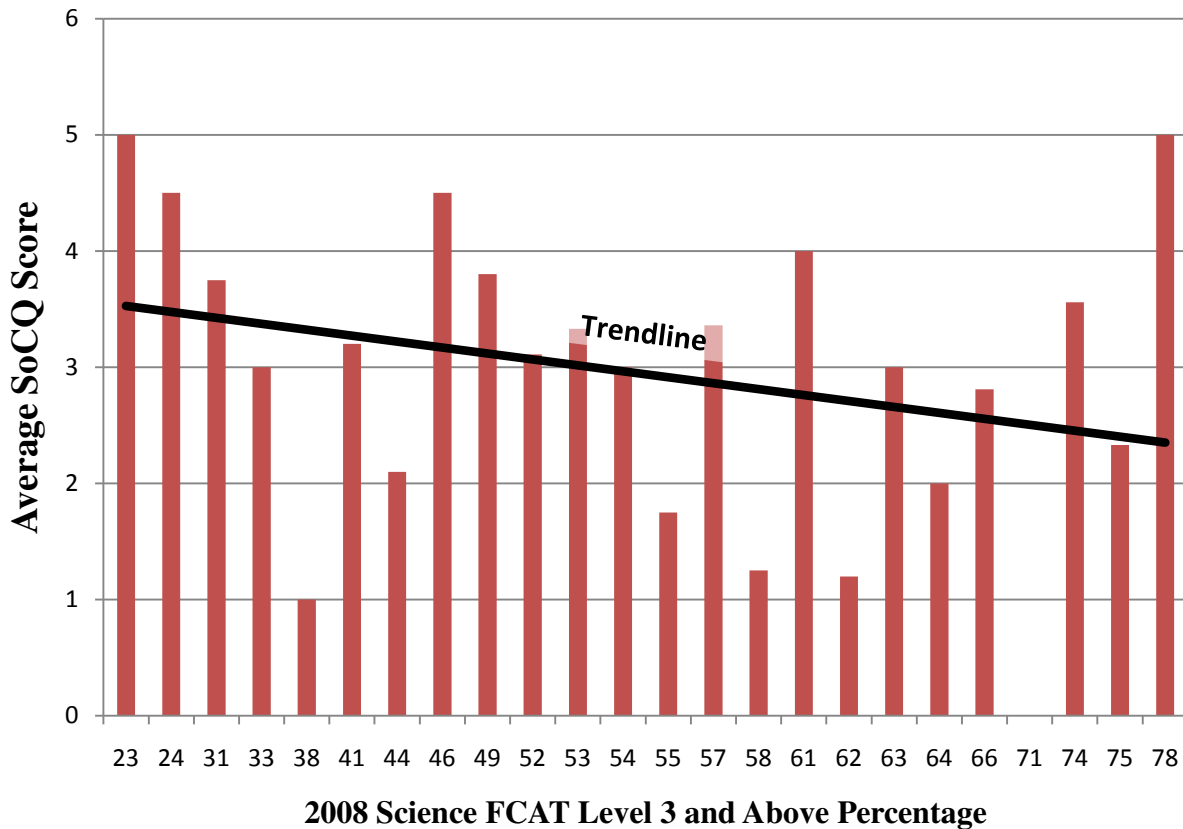


Figure 6: Individual School SoCQ Score based on FCAT Science Level 3+ Percentages

While the SoCQ data gave a glimpse into teacher beliefs, knowing a respondents' peak score did not paint the entire picture. The Stage of Concern that a participant fell into provided an indication as to how far into the implementation of the reform they felt they were, but not how they felt about the reform itself in many cases. A peak score of Stage 2 for example, suggested that the respondent had personal concerns about the reform, however, "Although these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance" (George et al, 2006, p. 53). Qualitative analysis was necessary to further delineate how teachers felt

about the reform in a way that would allow meaningful support to teachers during reform implementation.

Qualitative Analysis

While the quantitative differences between groups were not immediately obvious in all cases, open-ended responses did reveal that teachers' beliefs were extremely varied. From careful analysis of the responses, four assertions became apparent: the greatest differences in beliefs were found during grade level comparisons, middle school teachers were more likely to respond that they believed they were involved in the reform process than the elementary teachers who were more likely to believe that they needed more information concerning the reform, teachers at schools with higher poverty rates and lower testing performance tended to hold more optimistic beliefs concerning the reform, teachers were more likely to indicate their beliefs involved personal concerns with the reform rather than concerns for students or managing the reform. Further analysis resulted in the observation of three layers of categorical divisions within teacher beliefs which further differentiated them (Fig 7).

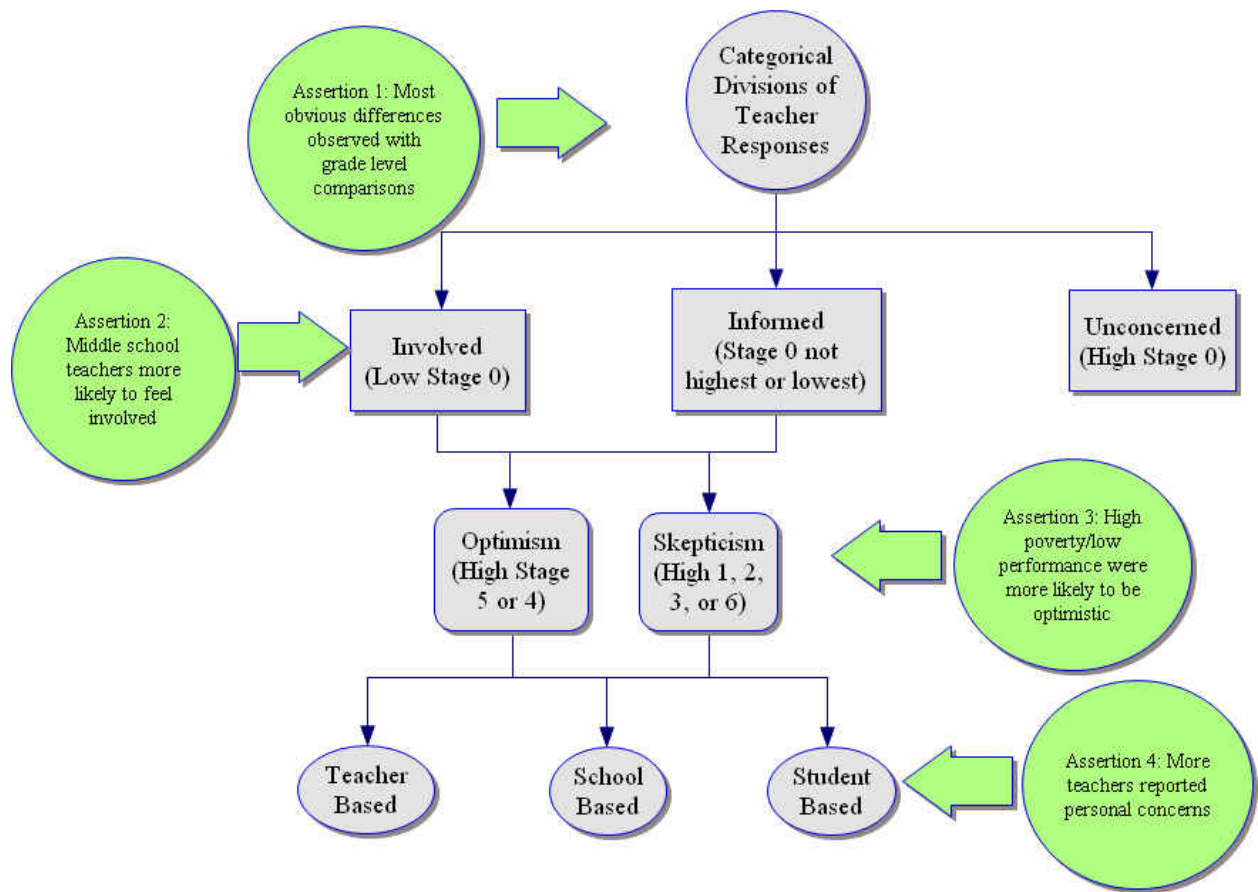


Figure 7: Response Assertions and Categorical Divisions

As indicated by the first assertion: The most obvious differences were observed with comparisons by grade level. In order to address all of the research questions, analysis was also necessary for FCAT performance and SES percentage comparisons and those comparisons were the source of the remaining assertions. The initial categorical division, Involvement, separated those who were very aware of the reform and those who did not seem to have it on their educational radar screens, referred to from here on as “Involved vs Unconcerned.” Teachers, who were at least informed, were further divided by their beliefs about the reform using the Value categorical division that was separated into “Optimism vs Skepticism.” And whether the

teachers were looking forward to the reform or dreading its implementation, their beliefs fell into a final categorical division, Proximity, characterized as “Teacher-based vs Student-based vs School-based.” This last division came about as the teacher responses appeared to focus either on the concerns for themselves as teachers, for their students, or for their school’s support structure. Each category was further supported using the common organizations of teacher responses (APPENDIX B) as provided by George, et al (2006). The average SoCQ scores for each group were reported, although beyond the initial Involvement division it was more useful to look at the breakdown in SoCQ trends within the groups, therefore both were provided.

Involvement Categorical Division: “Involved vs Unconcerned”

The second assertion, that middle school teachers tended to believe they were more Involved than elementary teachers and the elementary teachers believed they needed more information about the reform, was supported with the findings from the initial categorical division. Analyzing the open-ended items in relation to this division “Involved vs Unconcerned,” was a critical piece for reinforcing whether a teacher’s Stage 0 score as described by George, et al (2006), did in fact correlate to their level of familiarity with the reform itself. Peak Stage 0 scores categorized the respondent generally as “Unconcerned” (APPENDIX B) with high scores in this category typically indicating that other issues were of greater priority and those with low Stage 0 scores usually saw the innovation as critical to them. For this assertion, participants with peak Stage 0 scores (Unconcerned) were compared to those whose lowest score was Stage 0 (Involved). The Unconcerned group responded in ways suggesting that the impending use of new science standards in the curriculum was not a concern to them while the Involved group

responded in such a way that one would assume they felt part of the transition itself. The average peak SoCQ score for the entire Involved group was 3.06 (management concerns) compared to the Unconcerned group which by definition had an average peak SoCQ score of 0. Relating the assertions back to the original hypotheses was possible through analysis of each categorical division based on the three identified factors which affected teacher beliefs: grade level, socio-economic status, and FCAT performance.

Grade Level Comparison

Comparisons began in each category with grade level separations as the quantitative data indicated that this would be where the greatest variability between the groups would be found. Particularly with this division the differences between grade levels was critical in support of the second assertion. Of the 59 middle school teachers who responded to the SoCQ, 21 (35.6%) had a Low Stage 0 score (Involved) while only six (7.1%) of the 84 elementary school teachers who responded fell into this category. Respondents who received their lowest score in this stage are said to be "...an experienced user who is still actively concerned about the innovation," (George, et al, 2006, p. 53) and "...views the innovation as an important part of his or her work" (p.48). None of the teachers had begun implementation of the Next Generation Standards in their classrooms at the time of the survey distribution. So their "experience" would have been with deconstructing the standards and developing the curriculum that would be used in future years. This occurred during multiple professional development opportunities that the majority of 3-8 teachers had participated in to varying degrees. Indeed, the average peak SoCQ score for the Involved middle school teachers was 2.82 and for the Involved elementary teachers it was 3.92

which puts both groups somewhere between non-users and users according to George, et al (2006).

These teachers tended to have detailed responses for each of the open-ended items (particularly the middle school teachers), which will be shown in further analysis of SES and FCAT. The following quote is a typical example of a middle school teacher who understood the changes implied with the Next Generation Standards:

“My background in the Space Sciences is limited so I’d need some refresher and exposure to advances since I was in school in the 70s!! In the physical sciences I’d appreciate new technology support-nanotech, biometrics, and genetic engineering for example. It’s hard to excite students about new frontiers you don’t know about yourself.”

(#8)

With opposing levels of concern for the reform to the aforementioned teachers, three middle school teachers (5.1%) and ten elementary school teachers (11.9%) fell within the High Stage 0 category. Respondents who have this SoCQ score were “...not concerned about the innovation” (George, et al, p.53) and may have felt that “...other things, innovations, or activities are of greater concern than the innovation under consideration...” (p.48) To delve deeper into this assertion, all of the open ended items were analyzed to attempt to capture the reason for the lack of concern in those teachers with High Stage 0 SoCQ scores. While one of the middle school teachers did not answer the open-ended items, another middle school teacher in this category presented a conundrum as their responses seemed particularly well versed in the implications of the reform for someone whose score indicated they were unconcerned. For

example, when asked about the implications of the reform on student assessment performance (Question #2) the response was:

“I believe science test scores will rise – eventually – once all teachers are consistent with the grade level content. Transient students are at a disadvantage during testing and many concepts cannot be recalled from prior years.” (#29)

The third Unconcerned middle school teacher had a response for Question #2 that seemed more in line with the characteristic beliefs of a peak Stage 0 respondent according to George et al (2006):

“That is unknown, but we need to pick a program and stay with it. We cant change the hypothesis in the middle experiment. Over and over again.” (#136)

Of the ten elementary teachers who had a High Stage 0 score, four did not complete the open ended items. Three responded that the reform would involve “more work” (#24, #69, #86) and five (#24, #66, #69, #78, #86) indicated that they believed that the science reform would require “more materials” and/or “more supplies.” The group’s responses to the items concerning the effect of the reform on student learning (Question #1) were relatively vague:

“That depends on how and when it is implemented.” (#24)

“Students will understand concepts better.” (#66)

“Improve it.”(#86)

SES Comparison

With the differences in involvement beliefs of teachers based on grade level uncovered, response comparisons within the Involvement division continued with respect to free and reduced lunch percentage. This second comparison did not result in widely disparate characteristics between the “Involved” and “Unconcerned” groups. For the 27 participants who because their Stage 0 score was their lowest were considered “Involved,” the average percentage of students in their schools on free or reduced lunch was 34.2%. Of this group, three teachers (11%) worked in schools with more than 50% of its students on free or reduced lunch, a number that typically indicates a high poverty school. Two of those teachers worked at the same school and although they both had uncertain thoughts concerning the reform, they looked at the potential impact on student learning (Question #1) in very different ways:

“I’m not sure. It’s very difficult to see the connections between the topics as they are presented. I haven’t seen an explanation of why they were grouped as they are other than ‘learning progressions’.” (#42)

“If used as is it should increase the level and depth of student knowledge.” (#45)

Comparatively, the 13 participants with a peak Stage 0 score labeled as “Unconcerned,” had an average of 34.0% of the students in their schools on free or reduced lunch. Two of the 13 teachers (15.4%) worked in high poverty schools as defined by their over 50% free or reduced lunch value. For one of these teachers (#93), the open-ended response to Question #1 clarified immediately why a peak Stage 0 score would have resulted from their survey answers:

“I don’t know what it is. I teach science rarely. Writing takes up all my time since I’m in 4th (grade).”

Both groups for whom the Stage 0 score was significant, either low or high, averaged free and reduced lunch percentages below the mean of the entire participating sample (36.9%). Even though there were far more “Involved” participants than “Unconcerned” participants, the make-up of the groups when organized by SES is too similar (34.2% vs 34.0%) to draw any meaningful conclusions about the relevance of a school’s free or reduced lunch percentage alone, concerning a teacher’s feelings of involvement in the science reform in question.

FCAT Performance Comparison

After analyzing differences between grade levels and SES, a comparison by the FCAT performance history of the schools in which the participating teachers worked, gave further insight into the factors which affect teacher beliefs concerning reform. As described previously, of the 143 participants in this study 27 (19%) received a Low Stage 0 score indicating that they felt involved in the reform effort. Within this group, the average percentage of students with a Level 3 or higher on the 2008 FCAT Science was 55.4% and five of the twenty-seven teachers were working at schools with under 50% passing rate on FCAT.

Within the group of involved teachers divided based on FCAT, there seemed to be one unique teacher (#132) whose school’s 2008 FCAT passing rate was 23%, a full 18 percentage points below their nearest colleague. The responses of this teacher to the open-ended items did not allow for much insight into why this particular teacher at a low performing school felt

involved in the reform while comparative teachers did not. In fact for Question #2, which asked about the potential effect of the reform on student's standardized test scores, this teacher gave a puzzling response:

“Hopefully students will take more interest in global warming efforts.”(#132)

At the very opposite end of the FCAT performance spectrum were three Involved teachers who work at a school with 74% of its students having achieved at Level 3 or higher. Unlike teacher #132, all three of these teachers had very clear (and skeptical, as described in the second categorical division) responses to the open-ended items. For example, a response from one of these teachers at a higher achieving school to Question #3 concerning how the reform would affect them as a teacher was:

“All new lesson plans, lab, test, new activities. Total change of what we are teaching. Worry about the transition period for grade 6 – no books or resources for the 1st 2 years.”
(#17)

In fact, the tendency for the group seemed to be that the teachers at higher achieving schools had more definitive responses than those at lower achieving schools, although this was a difficult characteristic of responses to quantify. A comparison of two teacher responses illustrates this claim:

Teacher from 66% passing school: “I believe students will spend more time on concepts/new benchmarks. Also students will need to be provided with other reference materials besides the textbook.” (#105)

Teacher from 49% passing school: “Hopeful for improvement.” (#41)

In examining the “Unconcerned” (High Stage 0) group’s responses, there was a more pronounced difference from the “Informed” group than what the SES comparison yielded, yet still under 2% points. The average 2008 Science FCAT passing rate at the schools which the teachers in this group taught was 56.8%, and no one taught in a school with a below 40% passing rate. Overall the “Unconcerned” teachers worked at schools with students who performed better on the FCAT than the “Informed” teachers and both groups had average FCAT passing rates that were higher than the mean for the entire sample (54.6%).

Table 4: Summary of Involvement Category Analysis

Group	n	Average Peak SoCQ	Average Free or reduced Lunch%	Average Science FCAT Level 3+%
Entire Sample	143	2.84	36.9%	54.6%
Category Analysis Group	40	n/a	34.1%	55.9%
Involved	27	3.06	34.2%	55.4%
Involved Elementary	6	3.92	n/a	n/a
Involved Middle	21	2.82	n/a	n/a
Unconcerned	13	0	34.0%	56.8%
Unconcerned Elementary	10	0	n/a	n/a
Unconcerned Middle	3	0	n/a	n/a

Beyond the differences between grade levels identified within the first assertion, the findings of the Involvement category (Table 4) were: 13 of the 143 participants received a peak Stage 0 score indicating that they are unconcerned with the reform; 27 of the 143 participants had their lowest score in Stage 0 indicating that they feel they are involved with the reform this

group had an average peak SoCQ score of 3.06; middle school teachers' average peak SoCQ was lower (2.82) perhaps indicating that they have more personal concerns (Stage 2) than elementary teachers (3.92); SES did not seem to have a major impact on feelings of involvement, although the teachers at both ends of the spectrum for this division tended to be from schools that had fewer students on free or reduced lunch than the entire sample group; similarly, FCAT performance did not seem to be a major determining factor in feelings of involvement but the 40 teachers under analysis with this category tended to be from schools that had more students pass the FCAT than the entire sample group.

Value Categorical Division: "Optimism vs Skepticism"

The third assertion, suggested that teachers in schools with high poverty and low FCAT performance were more likely to have optimistic beliefs toward the reform. In support of this assertion, another division within the responses was created. The basis for continued analysis of teacher responses came with the acknowledgement that not every teacher fell within either the High or Low Stage 0 categories, which was to be expected. As indicated previously, only a select group of teachers (those who were working on the curriculum writing) would have been "involved" with the implementation of the new standards at the time of the survey though most would have heard of their impending use within the district. The majority of the teachers would therefore expectedly be informed, but not involved which eliminates their Stage 0 score as being the most relevant.

The next division, "Optimism vs Skepticism" developed exclusively from the participants' open-ended responses. Because of this, not every participant was included in this

grouping because some did not answer the open-ended items. Additionally for this category, a few participants' answers could not be confidently assigned a skeptical or optimistic value so they were not included in this analysis. For example in response to Question #1 concerning the effect of the reform on student learning, responses that could not be assigned a value were:

“Students need to be more accountable for their learning.” (#122)

“Hopefully lesson the number [of benchmarks] per grade level.” (#90)

Rather than try to interpret these answers one way or the other, these teachers along with 7 others with vague responses and 21 others who did not answer the open-ended items, were removed from consideration for this category leaving 100 teachers' data available for analysis.

It was observed that overall teachers with a peak Stage 1 (needing more information), Stage 5 (concerns over collaboration) or peak Stage 4 (concerns over students) score tended to be optimistic toward the reform while those with peak Stage 2 (concerns over self), Stage 3 (concerns over management), or Stage 6 (concerns with ideas to improve) tended to respond with more skepticism. A discussion of the differences in beliefs based on the locus of concern will come later with analysis of the final assertion using the third category, Proximity.

Grade Level Comparison

In almost every case, the teachers' responses to any of the open-ended items could have been used to determine their division within this second category as their skepticism or optimism was generally consistent in all four questions. Therefore, for the analysis of this category the question to which the participant was responding has been indicated along with each quote.

Overall, the 40 teachers in the Skeptical group had an average peak SoCQ score of 3.40, slightly higher than the Optimistic group's average of 3.28. As with the Involvement category, differences between middle and elementary school teachers were apparent, and even though their average peak SoCQ scores were similar (both within and between the groups), breakdowns of the scores shows important variability.

Of the 59 middle school teachers in the sample group, 49 were part of the Value division analysis (three teachers had a peak Stage 0 score and seven did not respond to the open-ended items or had vague responses). From this group, 28 middle school teachers (57.1%) gave what were qualified as skeptical responses to the open-ended items. The average peak SoCQ score for the middle school teachers within the skeptical group was 3.32, suggesting that they were primarily concerned about management of the reform (Stage 3) which seven teachers (25.0% of the group) did in fact have as their actual peak score. However, it was noteworthy that seven other teachers (25.0%) had a peak Stage 6 score indicating they already knew about the reform and had thought of ways to improve it, while eight more teachers (28.6%) had a peak Stage 2 indicating they had personal concerns about the reform (George, et al, 2006). Therefore in this case, the beliefs were pretty evenly divided and were further described with the third categorical division. Despite the differences in the focus of their skepticism, responses from middle school teachers had a similar assertion of frustration with continuous change including:

Question #1: "Who knows? In this school district we skip from one program to another without giving any 1 program the time to succeed or fail. One person makes the decision, whatever lip service is paid to teachers. That a decision was not made from the first time this subject was brought up is very hard to believe." (#11)

Question #2: “I feel like we keep changing our scope and sequence and that we don’t give the needed time to see the results.” (#16)

Question #3: “It sounds like it is one more intent to reinvent the wheel. The school district keeps copying ideas and strategies that might be working in other counties or places without taking in consideration what are the needs here. Eventually like everything they’ll go back to what we did before.” (#60)

Question #4: “I’ll probably retire. This is a waste of time and money for something we have tried before and failed. With this economy, you can’t even pay your teachers!” (#129)

The remaining 21 middle school teachers (42.9%) who were analyzed under the Value category gave markedly different answers to the open-ended items. The average peak SoCQ score for the middle school teachers within the optimistic group was 3.39, almost identical to the score for the skeptical group. But the breakdown of the scores was quite different. Within the optimistic middle school group there were eight teachers (38.1%) with a peak Stage 5 score which suggests their concerns were with coordinating others to use the reform. An additional six teachers (28.6%) had a peak Stage 2 score, with only two teachers actually receiving a peak Stage 3 score. The more optimistic responses concerning how the impending implementation of the Next Generation standards would affect the schools, the teachers, and the students included:

Question #1: “Provide a holistic approach to thinking and learning about science. Provide guidelines/structure for further accountability.” (#55)

Question #2: “Increased comprehension and retention due to increased exposure,

repetition, and application.” (#138)

Question #3 “I’ll move from being a specialist to a generalist-I’m already there in many ways. I’ll be able to bring my enthusiasm for biological sciences to play as I’d be teaching a little bit of bio with each topic (and earth science and physical science). It’s about how they relate and that’s lots of fun to get students to see.” (#8)

Question #4: “Assistance in integrating concepts through lab activities would be great.” (#30)

Of the 84 elementary teachers who participated in this study, 52 were at least informed (did not have a peak Stage 0) and provided answers for the open-ended items. Unlike the relatively evenly divided middle school group, of the 52 elementary teachers, most (40 or 76.9%) had responses which were categorized as optimistic. While the average peak SoCQ score of the elementary teachers within the optimistic group was 3.23 (only 0.16 below the optimistic middle school group), there was a startling difference when individual scores were analyzed. Once again peak Stage 5 scores were the most prevalent with 15 teachers (37.5%) and only a small percentage actually scoring a Stage 3 (four teachers or 10.0%). But the contrast came with the 12 teachers (30%) who scored a peak Stage 1 indicating that they needed more information about the reform, a far higher percentage than the three (14.3%) middle school teachers in the optimistic group with a peak Stage 1 which served to further clarify the first assertion and the continued description of the differences between middle and elementary school teachers. Those teachers in this group who did not believe they needed more information concerning the reform had very specific responses to the open-ended items:

Question #1: “Students will be exposed to in-depth learning of science concepts.

Students will be engaged in inquiry based learning and constructivism which will lead to a better understanding of concepts.” (#7)

Question #2: “I think once implemented it will take about 5-6 years to show an increase in standardized testing scores. Once each grade level buys into the reform students’ overall concept knowledge should increase year to year.” (#116)

Question #3: “Teachers will hopefully show a revival of science interest.” (#132)

Question #1: “I believe students will begin to gain a better understanding of the many different aspects of our scientific culture.” (#142)

The 12 (21.8%) elementary teachers remaining who could be analyzed using the second category, had answers that expressed negative feelings about the reform. With the highest SoCQ peak score of the groups within this division, the elementary teachers within the skeptical group averaged a 3.58. Unlike any of the other groups, there was no clear pattern of scores and no one score dominated the group. Of the 12 teachers, two each had peak scores of Stage 1, Stage 3, and Stage 5, and three each had a Stage 2 and Stage 6 peak score. Thus suggesting that while they shared negative feelings toward the reform, the focus of those feelings differed greatly (which will again be addressed in the Proximity categorical division). Although there were far fewer than the optimistic elementary group, the elementary school respondents within the skeptical group were very clear with their feelings toward the reform:

Question #1: “I believe we may be doing injustice to our students by NOT reviewing some skills across the grade levels.” (#115)

Question #3: “Telling a teacher what to teach and limiting a teacher to such a limited amount is utter nonsense. Repetitive learning, I was told, helps a student learn. The science reform is more ‘building block’ learning not repetitive.” (#36)

Question #3: “It will require me to put more time into lesson plans, investigations, and research on the new benchmarks to provide my students with information that can’t be found in their textbook.” (#105)

SES Comparison

An analysis of differences in beliefs based on SES within the Value division did not provide as striking results as comparisons based on grade level, but differences did exist which supported the second assertion. Within the 40 person group that gave skeptical responses, the average percentage of students on free or reduced lunch was 34.1%, which was 2.8% points below the mean for the entire sample. The percentages ranged from 13 to 77% with only six of the teachers (15.0%) working at schools above 50%. Teachers in these higher poverty schools had an average peak SoCQ score of 2.83 with four of the six scoring a peak Stage 2 score indicating their concerns are personal. The remaining 34 teachers in the skeptical group were in schools with below 50% free or reduced lunch had an average peak SoCQ score of 3.56, with large percentages of teachers with Stage 6 and Stage 2 scores as described previously in the grade level analysis. The two teachers at the school with the highest percentage (77%) of its

students on free or reduced lunch, scored Stage 6 (suggestions for improvement) and Stage 3 (management). Samples of the skeptical responses for these teachers were:

Question #3: “Great in theory. I think it’s unrealistic right now because of the way the schedule is for Title 1 and no way to do hands-on in a portable. It takes prep time and none is given.” (#10, Stage 3)

Question #2: “I will still have to teach testing format. Science reform does not seem to do this. They need to know what the test will look like.” (#71, Stage 6)

These were very moderate compared to many others in the group, who had much more skeptical answers. For example, some teachers from one of the most affluent schools (19% free or reduced lunch) responded:

Question #3: “It could lead to chaos. We tried this about 10 years ago with disastrous results.” (#137)

Question #4: “More work to develop new activities. Less money already available now so new reform will just stress an already weakened system – especially teachers who are the key to any effective program.” (#59)

By comparison, the 60 teachers who were found to have optimistic beliefs toward the science reform, were at school that had an average free or reduced lunch percentage of 37.5%, slightly higher than the 36.9% mean for the entire sample. The percentages for this group spanned the entire range of the sample data, with a low of 8% and a high of 77% with thirteen teachers (20.3%) working at schools with above 50% free or reduced lunch. Within this

optimistic group, the majority of teachers received either a Stage 1, Stage 2, or Stage 5 peak score. As a group, the teachers who scored Stage 1 (needing more information) or Stage 5 (concerns over coordination), came from schools with similar SES (40.1% and 40.7% free or reduced lunch respectively). But the teachers within the Stage 2 group (personal concerns, tended to come from schools with fewer students on lunch assistance (29.0%). As with the skeptical group, the teacher at the school with the highest percentage of free or reduced lunch had much more subdued responses than their colleagues in schools with lower percentages:

Teacher from 77% school: “I think it will benefit them because it is more hands-on.”
(#70)

Teacher from 8% school: “I think it will make me a better teacher. Always changing and trying new methods help mold me as a professional to allow my instruction to improve for the benefit of my students.” (#97)

FCAT Performance Comparison

As with each categorical division, the final piece of evaluation of the Value category was a comparison based on FCAT performance. While differences were not dramatic between the two groups in this category, the broader picture of the beliefs of the teachers who participated in this study continued to come into focus. The 40 teachers in the skeptical group had an average of 56.9% of the students at their schools score Level 3 or higher on the 2008 Science FCAT. This group therefore came from schools whose students scored 2.3% points higher than the mean for the entire sample (54.6%). The group ranged from 24 – 74% Level 3 or higher, with only two teachers at schools below 40%. Of these two teachers at low performing schools, there was a

discrepancy of peak SoCQ score, with one receiving a peak Stage 6 (24% FCAT) and the other a peak Stage 3 (31% FCAT). These same teachers were identified previously in the SES comparison as being atypical within the group and quotes from their open-ended responses can be found in that section.

The highest performing school (74%) had seven of nine teachers who responded to the survey respond in what was categorized as skeptically. While these teachers averaged 3.36 as their peak SoCQ score, none of the teachers received a peak Stage 3 score individually. Two of the teachers scored a peak Stage 6 and three scored a peak Stage 2, which was to be expected since these scores dominated the skeptical group as a whole. A sample of responses from the teachers at this school follows:

Question #1: “Students will receive a gloss over of topics without actual in-depth understanding.” (#20)

Question #2: “Sadly, I’m afraid that if we’re talking integrated it will hurt the ability of many students who haven’t matured as a student. Without a clean, fresh start, students who were weak at the start will be at an even greater disadvantage than it was a weakness the occurs during the discrete program.” (#21)

Question #3: “I will be very unhappy and frustrated.” (#22)

In contrast to the skeptical group which had higher FCAT performance levels than the entire sample, the optimistic group had an average FCAT passing score of 53.4%, just about one point below the overall mean. This group comprised of 60 teachers, ranged from 23-78% Level 3 or higher scores within seven teachers in schools (all elementary) with below 40% of their students passing the Science FCAT. Of these teachers within the optimistic group in lower

performing schools, four received a Stage 5 peak score and two a Stage 1 peak score. The seventh member had a peak Stage 4 score which was a semi-atypical score of the group as a whole (only 10% of the 100 participants received a peak Stage 4 score). As a window into the Stage 4 mind, this teacher’s response to Question #2 concerning the effect of the reform on student learning was:

“Hard to say – some students having trouble thinking for themselves so they will have to acquire confidence in themselves. Overall it should be positive, but may take time to show up.” (#74)

Among the five teachers at the highest performing schools (FCAT passing rates of greater than 70%), three had a peak score of Stage 5, one of Stage 1 and one Stage 2, showing once again that although FCAT performance did seem to have an influence over the beliefs of the teachers in this study, this is indeed a multifaceted issue.

Table 5: Summary of Value Category Analysis

Group	n	Average Peak SoCQ	Average Free or reduced Lunch%	Average Science FCAT Level 3+%
Entire Sample	143	2.84	36.9%	54.6%
Category Analysis Group	100	3.34	35.8%	55.2%
Skeptical	40	3.40	34.1%	56.9%
Skeptical Elementary	12	3.58	n/a	n/a
Skeptical Middle	28	3.32	n/a	n/a
Optimistic	61	3.28	37.5%	53.4%
Optimistic Elementary	40	3.23	n/a	n/a
Optimistic Middle	21	3.39	n/a	n/a

In addition to supporting the third assertion with data showing differences in teacher beliefs based on SES and FCAT, the findings of the Value category (Table 5) were: 100 of the 143 participants received a peak score other than Stage 0 indicating that they are at least informed about the reform and were therefore included in the second assertion analysis; 40 of the 100 qualifying participants had responses that indicated that they feel the reform will have a negative impact on themselves, the students, and/or the school; this skeptical group had an average peak SoCQ score of 3.40; middle school teachers were more likely to respond skeptically toward the reform than elementary school teachers; within the skeptical group Stage 2, 3, and 6 scores were the most prevalent; within the optimistic group, the most common peak scores were Stage 5 and 1; analysis of peak SoCQ score within the skeptical and optimistic groups by SES and FCAT indicated discrepancies as to the specific focus of the concerns whether positive or negative.

Proximity Categorical Division: "Teacher-based vs Student-based vs School-based"

While the majority of the teachers could be divided simply according to their positive or negative views concerning the implementation of the new science standards, as described above, additional assessment of their responses uncovered that many had focused primary concerns related to how the reform would affect them as a teacher, how it would affect students, or how it would affect the school in general. From this a fourth assertion arose, showing that more teachers indicated their beliefs were related to personal concerns over others. Therefore, a third categorical division was developed, which divided the responses into what facet of education the

teachers' concerns related to most. This division emerged as a result of the definitions of the Stages themselves and came initially from the teachers' SoCQ peak scores with support from the open-ended responses.

As defined by George and colleagues (2006), scores within Stage 2 related to personal concerns, Stage 4 scores related to concerns about students, Stage 3 related to concerns about managing (school based) and Stage 5 scores related to concerns about coordinating with others (school based). Therefore the teachers' peak scores were the sorting factor for this categorical division. For teachers with peak Stage 1 (needing more information) or Stage 6 (ideas for improvement) scores, their second highest stage was used to determine under which proximity they should be categorized. In total, 103 participants were analyzed in this comparison, others were removed because they had a peak Stage 0 score, no responses to the open-ended items, and/or responses that were too vague to be categorized (three teachers whose responses were too vague for the Value analysis were suitable for the Proximity analysis). For each form of comparison (Grade level, SES, and FCAT), data were correlated for Teacher Based concerns using Stage 2 scores, for Student Based concerns using Stage 4 scores, and for School Based concerns using both Stage 3 and Stage 5 scores. All analyses also included those participants with peak Stage 1 or 6 scores but secondary peak scores in Stage 2, 4, 3, or 5.

Grade Level Comparison

Analysis for the Proximity division found that similar numbers of elementary and middle school teachers received peak scores in each of the three loci of concern: Teacher Based, Student Based, and School Based. However demographics of the schools at which teachers worked, were

in some cases drastically different between the grade levels. Overall, of the 103 participants under consideration with this category, 48 teachers (46.6%) were found to have peak Stage 2 scores (or peak Stage 1 or Stage 6 scores with Stage 2 as the second highest score), meaning that their most pressing concern was about the effect of the reform on themselves as teachers and that although “these concerns reflect uneasiness regarding the innovation, they do not necessarily indicate resistance” (George et al, 2006, p. 53). This group was evenly divided into elementary and middle school teachers. Of the 24 elementary school teachers in this group, 14 (58.3%) had peak Stage 1 scores with Stage 2 as their second highest score, indicating that while their concerns were personal they felt they needed more information on the reform. Alternatively, most of the middle school teachers in this group (15 or 62.5%) had peak Stage 2 scores suggesting that they felt adequately informed enough to support their personal concerns. A selection of the responses from this group shows the range of personal concerns, some more optimistic than others as described in the previous category:

“Since I haven’t experienced it yet, I don’t know. I’d assume that we’ll be a little stressed at first, then as time passes, we’ll be alright.” (#38)

“All new lesson plans, lab, test, new activities. Total change of what we are teaching. Worry about the transition period for grade 6 – no books or resources for the 1st 2 years.” (#17)

“Sharing books, equipment among 9 instead of 3; more planning units; additional personal time/less pay; more prep time; leaving work for substitutes when absent; absent students, make up work?” (#25)

Student-based concerns were prevalent throughout many of the teachers' open-ended responses, however only 11 participants (10.7%) had a peak Stage 4 score indicating that their most pressing concern was the effect of the reform on students. Once again, a similar number of teachers in both elementary (6) and middle (5) schools fell into this category. Only one participant, an elementary teacher, had a peak Stage 1 score with a second highest Stage 4 score, and no teachers had a peak Stage 6 score with a second highest Stage 4 score. While numbers of peak Stage 4 scores were relatively evenly divided between elementary and middle school teachers, the specific student-based concerns of the two groups were very different. Two of the middle school teachers felt the curriculum based on the new standards would negatively impact the students beyond 8th grade:

“I believe that the science reform is geared toward teaching students to prepare them for FCAT. It does not take in consideration what students need to learn for high school, college, and their role as citizens. The science reform is chopped into many pieces that seem not to make sense. It does not take in consideration the reality of what goes on in the daily routine in classrooms.” (#60)

“It will hinder their learning; does not coordinate with high school and college sciences.” (#15)

The other three middle school teachers were more vague in their hopes for the effect on students mentioning: “some improvement” in student test scores (#40), “assured coverage of all of the standards” (#123), and “increased comprehension and retention” (#138). Comparatively, five of

the six elementary teachers gave specific responses as to the benefits of the reform for their students including:

“I think the science reform will simply enhance student learning. I think it would allow the students to think creatively and critically through scientific inquiry.” (#101)

“Students will guide their learning acquisition through inquiry-based activities.” (#106)

Participants within the third category (Proximity), School-based concerns, were divided unevenly between Management issues (Stage 3) and Coordination issues (Stage 5). Far more teachers received peak Stage 5 scores (31) than peak Stage 3 scores (13) indicating that more of the participants with concerns at the school level, were focused on how to coordinate with other teachers to implement the reform than on how logistically the reform should be managed. In its entirety, school-based concerns were relevant to 42.7% of the group under analysis with this categorical division. Of the 13 teachers with Management concerns, six were elementary and seven were middle school with three middle school teachers actually having peak Stage 6 scores with second highest Stage 3. These three teachers by definition would presumably see ways to improve the management of the reform, but the responses from two of these teachers to Question #4 concerning what support would be needed to implement the reform, seem to suggest that for them improving the reform would entail avoiding it:

“I guess your people will give us your program and then we will know much extra time and energy will be required of us, then we will request support.” (#134)

“Listen to teachers. We don’t want to implement it. It is a waste of time with lack of funds.” (#59)

While the third teacher with a peak Stage 6 and second highest Stage 3 score, has a very particular improvement suggested:

“Lots of good quality, cheap, worthwhile labs developed.” (#21)

The remaining peak Stage 3 middle school teachers had one thing clearly in common: they were not anticipating a positive effect of the reform on their school as evidenced by these sample responses to Question #4:

“Make a job that is already out of control just that much worse.” (#11)

“5 more hours of planning time a week, less paperwork, books, supplemental materials, lab equipment, copies.” (#58)

As with most comparisons of beliefs by grade level, their elementary school colleagues tended toward more positive feelings for the reform even while giving some detailed needs for the faculty and school in order for the Next Generation Standards to be implemented effectively:

“Materials need to be available, organized, easily implemented and supported by curriculum. Experiments which can realistically be performed engaging the students.” (#65)

“Supply lessons, materials and outline of expectations. It must be taught equally, consistently across grade level.” (#64)

“A room, a sink, time, organized materials on a shelf, and less interruptions.” (#10)

The 31 peak Stage 5 participants were not as evenly divided by grade level as the Stage 3 group. The elementary teachers concerned with cooperating amongst their peers during the implementation of the reform outnumbered their middle school colleagues 18 to 13. All but one of the 18 elementary teachers in this group had true peak Stage 5 scores. As a group, these teachers had very detailed answers for what would be needed as support for the reform to be successful, often referring to professional development and other school-wide initiatives:

“I truly believe for this to work each school is going to need a science teacher to train and help each grade level know what is expected. Help them find what chapters in the book are now for their grade level. Help them with hands-on lessons to enrich the topic. In addition, make sure the school is supplied with the resources needed.” (#75)

“In-services for entire staff to see the connection between all grades and for ideas/lessons to help with standards not covered in adopted curriculum.” (#97)

“Professional development in: questioning techniques, constructivism and inquiry based learning, development of essential questions, science inquiry, and scientific knowledge.” (#7)

The peak Stage 5 group had some unique characteristics within its 13 middle school teachers. First, with only one exception, there was only one teacher per school in this category. In almost every other peak Stage, the teachers tended to cluster and multiple teachers from the same school would fall together. But with peak Stage 5 scores, between the 13 participants, 12 schools were represented. Since according to George, et al (2006) these teachers are “likely to be an administrator, coordinator, or team leader” (p. 54) this may mean these respondents were the

science department chairs or team leaders at their respective schools. Another peculiar aspect of this peak Stage 5 group was that unlike the middle school group as a whole, these teachers all had a positive outlook on the reform. Their concerns over coordinating the implementation of the new standards, while not wildly optimistic, often acknowledged the benefits of the reform to encourage teachers to work together:

“If done correctly, in a cross-grade coordinated effort, I believe students will retain a greater amount of material. By reinforcing each year’s learning in subsequent years, retention should increase.” (#19, Question #3)

“Unified faculty!” (#55, Question #4)

“Planning time, new resources, more equipment. Time for good ideas (re: a great lesson plan) to be shared with everyone, so as many people as possible benefit.” (#126, Question #4)

SES Comparison

Comparisons within the Proximity division based on percentage of students on free or reduced lunch yielded some obvious differences between the reform beliefs of teachers at schools with varying poverty levels. Overall, the entire group of 103 teachers’ responses analyzed for this category had a mean free or reduced lunch percentage of 36.9%. The group of teachers who received a peak Stage 5 score had the highest average with 39.3% of the students receiving lunch assistance. This group had a large range in their school’s SES however ranging from two teachers at schools with only 8% to three teachers at schools (all of which were elementary schools) with 77% of its students on free or reduced lunch. The 8% schools seemed

to be exceptions to the rule in this group as no other elementary schools represented had less than 30% poverty and only two middle schools did. In fact, even with these two teachers from low poverty schools, the 18 elementary teachers in the peak Stage 5 group had a much higher overall free or reduced lunch percentage (43.0%) than their 13 middle school peers (32.5%). Of note, these elementary teachers, with concerns focused on coordinating with others on the reform, as a group worked at schools with more students of poverty than any other group within the Proximity division. As to be expected perhaps, many of these teachers mentioned needing materials as part of the effort to work with others on implementing the new standards, for example:

“Team, administrative, and district support is needed to ensure materials are available for hands-on activities as well as resource materials.” (#112)

“A plan of suggested implementation, materials to support all concepts and suggestions for ways to use other materials that have been purchased for the schools every year” (#116)

“Materials provided by the school/district that correlate to the new standards (labs, textbooks, assessments).” (#52)

The second highest average free or reduced lunch percentage was within the peak Stage 2 group. These teachers with personal concerns about implementing the reform came from schools with an average of 37.5% of their students in the lunch program, almost 2% less than the peak Stage 5 group but still more than 1% higher than the mean for the entire category sample. This group was similar demographically to the peak Stage 5 teachers in that the SES of the schools

represented ranged from 8%-77% students receiving lunch assistance and that overall the elementary schools (39.0%) had a higher percentage of free or reduced lunch than the middle schools (36.0%).

However, the Stage 2 group uniqueness lay in its large proportion (14 of 24) of elementary teachers with peak Stage 1 scores (needing more information) and these teachers tended to come from schools with fewer students of poverty (36.3%) than the entire personally concerned group. Even those elementary teachers without peak Stage 1 scores, seemed to express a lot of uncertainty within their concerns, regardless of SES:

“Since I haven’t experienced it yet, I don’t know. I’d assume that we’ll be a little stressed at first, then as time passes, we’ll be alright.” (#38, 13% lunch assistance)

“I don’t know enough about the reform. First I would need to be allowed to teach science throughout the year and not be forced to wait until after FCAT.” (#92, 77% lunch assistance)

Similar to the elementary teachers, the middle school teachers within the Stage 2 group were clustered together, in this case most (15 of 24) were the recipients of true peak Stage 2 scores (rather than peak Stage 1 or 6 with a secondary peak). However the range of average percentage of students on free or reduced lunch for the middle school subgroups in this proximity was much smaller (1.9) than the elementary schools (14.6) suggesting fewer differences in SES between those teachers with personal concerns who did and did not need more information concerning the reform.

The group of teachers within the peak Stage 4 group (concerns about students) had the second lowest percentage of poverty at 35.1% overall, although it is important to note that two elementary teachers with high percentages of students on free or reduced lunch (77% and 64%) may have skewed this value since this group was so small. Of the remaining nine teachers, no schools that they worked in had over 45% poverty, so without those two teachers, the SES of the peak Stage 4 group would have been much lower. In comparing those two teachers to the rest of the group it seems, that although their demographics were drastically different, their feelings about the reform were not as evidenced by their responses to Question #1 which asked about the effect of the reform on student learning:

“It should improve their aptitude in science and drive further curiosity.” (#143, 64% lunch assistance)

“I think the science reform will simply enhance student learning. I think it would allow the students to think creatively and critically through scientific inquiry.” (#101, 30% lunch assistance)

Among the middle school teachers, SES seemed again to not be a factor in determining their specific feelings toward the reform as it relates to students. For example, two teachers with very similar free or reduced lunch percentages (19% and 17% respectively) had polarized responses to Question #2 which ask about the potential effect of the reform on student achievement on standardized assessment:

“According to my experience, I believe that the impact is going to be negative.” (#60)

“As teachers get to know and understand standards more, hopefully students’ scores will improve.” (#123)

The lowest average percentage of students on free or reduced lunch (30.4%) was found in the peak Stage 3 group. Once again this was a small group (13 total teachers) so one or two teachers in schools with outlying SES percentages could have caused a dramatic difference in the overall average. However in this case, the two teachers at elementary schools with poverty levels unlike the rest of the Stage 3 group basically balanced themselves out as one came from a school with 77% of its students on lunch assistance and the other from a school with 9%. Both of these teachers at drastically different schools had responses to Question #3 (how the reform would affect teachers) that acknowledged the extra work but one teacher saw potential, while the other anticipated problems:

“Great in theory. I think it’s unrealistic right now because of the way the schedule is for Title 1 and no way to do hands-on in a portable. It takes prep time and none is given.”
(#10, 77%)

“Increase my workload, force me to focus more on science and hopefully help me become a better scientist.” (#65, 9%)

The other responses from these two teachers continued to show a distinct difference in their feelings about the reform in general with teacher #10 markedly more pessimistic than teacher #65, suggesting that in this case with elementary school teachers, SES may have played a role in the specific beliefs about the reform for those teachers who have management concerns.

When comparisons were made between the highest and lowest SES middle schools, differences were not noticed. The teacher (#11) from the middle school with the most poverty in this group (42% free or reduced lunch) had equally skeptical beliefs concerning the reform as the teacher (#58) from the middle school with the least poverty in this group (19% lunch assistance). Examples of their responses were provided within the Grade Level Comparison of this division. It should be pointed out that the range in SES was not nearly as dramatic as the two elementary teachers which may account in part for the lack of differences in feelings.

FCAT Performance Comparison

Analyzing the 2008 Science FCAT results within the Proximity category resulted in the exact reverse pattern of the SES results. The peak Stage 5 group, with the highest average poverty percentage (39.3%), had the lowest average FCAT performance (52.6% Level 3 or above). While the peak Stage 3 group, with the lowest percentage of students on free or reduced lunch (30.4%), had the highest average FCAT performance (58.4% Level 3 or above). The peak Stage 4 and peak Stage 2 groups switched positions as well, from 3rd and 2nd respectively in terms of percentage of students on lunch assistance to 2nd (54.5%) and 3rd (54.3%) in terms of the number of students who passed FCAT at their schools. This inverse relationship between FCAT and SES will be addressed later in the Further Considerations section as it was not part of the original set of research questions but seemed to be an important finding in terms of understanding the needs of this particular school district.

Due to this unique relationship between FCAT performance and SES, analysis of the Proximity division based on FCAT passing percentages, looked very similar to that based on free

or reduced lunch percentages. Many of the same teachers that were outliers within their groups due to poverty levels were still outliers with FCAT performances. In terms of FCAT, as with SES, the peak Stage 3 group as a whole had the most divergent results from the entire 103 sample used for this category's analysis. Their 58.4% average FCAT passing rate was almost 4% points higher than that of the whole sample (54.3%), no other subgroup was more than 2% away from the sample mean. Within this peak Stage 3 group, the participant from the highest performing school (74% Level 3 or higher on FCAT) was a middle school teacher (#21) and the participant from the lowest performing school (31%) was an elementary teacher (#10). Despite their differing grade levels and school performance histories, the responses of these teachers to Question #2 concerning the effect of implementing the new standards on student achievement reflected similar concerns:

“Hard to tell since we (internally) determined that our student's biggest difficulty with test scores was their short and extended response. We've focused on this and I expect scores will improve due to this (not due to the science reform).” (#21)

“If it stays the same it is unfair. The test is applied science-curriculum is not applied-only concepts.” (#10)

Both teachers seemed to feel that changes in the structure of the test was (or would be) a more important factor in student success than changes in curriculum; although they indicated different aspects of the test that were critical.

The peak Stage 5 group was the only subgroup to have an average FCAT passing score below the sample mean, with an average of 52.6% of the students in the schools represented

having received a Level 3 or higher. This uniqueness was due in part to the inclusion of five teachers whose schools (all elementary) averaged below 35% passing on the 2008 Science FCAT. No other subgroup had more than two teachers with performance rates that low. Of these five teachers at low performing elementary schools, two had very similar and detailed explanations of what they believed would be the effect of the reform on student achievement (Question #2):

“The effects of the science reform will initially cause standardized testing to decrease as the teachers and students become familiar with learning about science. After a year or two of implementation we should see increases in our scores.” (#142)

“I think in 4 or 5 years if teachers are following it science results will go up. But for the first 3 years they will be stagnant if not drop a little due to holes that teachers cant fill in because there is no overlap.” (#75)

These responses seemed to align with the George, et al (2006) definition of peak Stage 5 scores that concerns are over coordinating with other teachers on the reform. The teachers above, appeared to have a big picture concept of how involving the entire school in reform will be critical in its success. The remaining three teachers from schools with low FCAT passing rates were not as clear or certain in their responses to this item, lacking support for but not negating their categorization within the Stage 5 concern group.

While the major function of this division was to support the fourth assertion which proported that more teachers reported personal concerns than student or school-based concerns, several other notable comparisons were discovered. The third categorical division (Proximity)

was summarized using Tables 6-9 below. The analysis required looking at the groups with Teacher-based, Student-based, and School-based concerns separately and within each group variations were noted. Overall, 103 teachers' responses were suitable for examination in this manner. The groups were primarily defined based on the participants peak score (Stage 2 indicated Teacher-based concerns, Stage 4 indicated Student-based concerns, and Stages 3 and 5 indicated School-based concerns). However, there were a number of participants whose peak score was either Stage 1 (needs more information) or Stage 6 (ideas for improvement) and therefore their secondary peak scores were used to categorize them within the Proximity division.

Table 6: Summary of Proximity Category Analysis – Stage 2 Personal Concerns

Group	n	Average Peak SoCQ	Average Free or reduced Lunch%	Average Science FCAT Level 3+%
Entire Sample	143	2.84	36.9%	54.6%
Category Analysis Group	103	n/a	36.9%	54.3%
Stage 2 (Personal)	48	n/a	37.5%	54.3%
Stage 2 Elementary	24	n/a	36.0%	54.7%
Stage 2 Middle	24	n/a	39.0%	53.8%

As noted in the fourth assertion, the largest Proximity group was the participants with personal concerns (Table 6). This group had a slightly higher (0.6%) poverty level than, and identical FCAT performance history to the entire group of 103 teachers. A large portion (58.3%) of the elementary teachers within this group had a peak Stage 1 score, with a secondary Stage 2 peak score suggesting that while they possessed personal concerns, they would have liked more

information on the reform. A similar sized portion of middle school teachers (62.5%) were strictly recipients of peak Stage 2 scores, suggesting that their personal concerns were more solidified than their elementary peers.

Table 7: Summary of Proximity Categorical Division Analysis – Stage 4 Student Concerns

Group	N	Average Peak SoCQ	Average Free or reduced Lunch%	Average Science FCAT Level 3+%
Entire Sample	143	2.84	36.9%	54.6%
Category Analysis Group	103	n/a	36.9%	54.3%
Stage 4 (Students)	11	n/a	35.1%	54.5%
Stage 4 Elementary	6	n/a	42.2%	51.2%
Stage 4 Middle	5	n/a	26.6%	58.4%

The smallest of the Proximity groups was made up of 11 teachers whose primary concern was the effect of implementing the reform on students (see Table 7). While officially this would mean only 10.8% of the participants in this study were concerned about the effect of the new standards on students, many more teachers mentioned student concerns within their open-ended responses. As a group, they had fewer students (1.8% less) on free or reduced lunch and slightly better (0.2% higher) FCAT passing rates, than the whole group under analysis with the third categorical division. But there were major differences between the elementary and middle school teachers within this group, once again supporting the first assertion. The elementary teachers came from schools with much higher poverty rates (15.6%) and much lower FCAT passing percentages (6.8%) than their middle school counterparts.

Table 8: Summary of Proximity Categorical Division Analysis – Stage 3 School Concerns (Managing)

Group	n	Average Peak SoCQ	Average Free or reduced Lunch%	Average Science FCAT Level 3+%
Entire Sample	143	2.84	36.9%	54.6%
Category Analysis Group	103	n/a	36.9%	54.3%
Stage 3 (Managing)	13	n/a	30.4%	58.4%
Stage 3 Elementary	6	n/a	33.5%	55.3%
Stage 3 Middle	7	n/a	27.7%	61.0%

Table 9: Summary of Proximity Categorical Division Analysis – Stage 5 School Concerns (Coordinating)

Group	n	Average Peak SoCQ	Average Free or reduced Lunch%	Average Science FCAT Level 3+%
Entire Sample	143	2.84	36.9%	54.6%
Category Analysis Group	103	n/a	36.9%	54.3%
Stage 5 (Coordinating)	31	n/a	39.3%	52.6%
Stage 5 Elementary	18	n/a	43.0%	50.6%
Stage 5 Middle	13	n/a	32.5%	55.4%

The final Proximity group was made up of teachers with School-based concerns and was divided into two pieces: those with concerns over managing the reform (peak Stage 3, Table 8) and those with concerns over coordinating with other teachers to implement the reform (peak

Stage 5, Table 9). While both groups had concerns that involved the school as a whole rather than themselves as individual teachers or their students, the demographics of the groups were very different. The peak Stage 3 group had average lunch assistance percentages well below (6.5%) the mean for the whole group of 103 teachers, while the peak Stage 5 group averaged above (2.4%) the group mean. In terms of FCAT passing percentage, the teachers in the peak Stage 3 group came from schools with average rates above (3.9%) the mean for the whole category, while the peak Stage 5 group had teachers from schools with average rates below (1.7%) the category mean. Despite these differences, both groups were made of elementary teachers from higher poverty, and lower performing schools than the middle schools teachers with similar concerns.

The mixed methodology strategy for data analysis yielded in depth descriptions of the beliefs of the teachers in this study concerning the upcoming transition to the Next Generation Standards in science. The initial quantitative analysis of the SoCQ instrument found statistically significant differences in beliefs between participants based on each of the identified school climate factors: grade level, socio-economic status, and FCAT performance. After establishing differences, more details were needed to better understand the nature of the differences. Initial analysis of the open-ended items resulted in four proposed assertions in teacher responses: one, the greatest differences in beliefs were found during grade level comparisons, two, middle school teachers were more likely to respond that they believed they were involved in the reform process than the elementary teachers who were more likely to believe that they needed more information concerning the reform, three, teachers at schools with higher poverty rates and lower testing

performance tended to hold more optimistic beliefs concerning the reform, and four, teachers were more likely to indicate their beliefs involved personal concerns with the reform rather than concerns for students or managing the reform. In support of these assertions, three categorical divisions were established to strengthen comparison abilities. While the first assertion pervaded each division with differences between grade levels consistently showing up as the most disparate, the remaining three assertions were reinforced primarily by a particular category. In Chapter Five implications of the analyzed data will be presented along. Also a suggested sequence of actions for implementation of science reform will be given along with needed future research.

CHAPTER FIVE: CONCLUSIONS

With a transition to new science standards looming in the future, knowledge of the beliefs of science teachers concerning those standards was critical to prepare a school district for the reform process. Knowing the inseparable relationship between science teacher beliefs and science reform efforts, this study represented the first step in increasing the likelihood that the reform in question would be successfully implemented. Research questions that guided this study questioned whether differences in science teacher beliefs concerning the reform would differ based on grade level, SES, and FCAT performance.

Teachers from grades 3-8 in one school district completed a survey asking for their beliefs toward the Next Generation Sunshine State Standards science curriculum. The responses to the survey were analyzed using both quantitative and qualitative measures to clearly delineate any difference between teachers based on the identified factors: grade level, socio-economic status, and standardized testing performance. Several assertions arose during the analysis which provided insight into the research questions: one, the greatest differences in beliefs were found during grade level comparisons; two, middle school teachers were more likely to respond that they believed they were involved in the reform process than the elementary teachers who were more likely to believe that they needed more information concerning the reform; three, teachers at schools with higher poverty rates and lower testing performance tended to hold more optimistic beliefs concerning the reform; and four, teachers were more likely to indicate their beliefs involved personal concerns with the reform rather than concerns for students or managing the reform

Based off of these assertions, implications for the support during and after the reform were discovered and proposed for consideration by the school district involved in the reform. What follows is a breakdown of those assertions with implications for proceeding with the reform efforts followed by suggestions for further research into the dynamics of the teachers in the district and support for the transition.

Research Question #1: Did science teachers' beliefs about science reform policies differ between elementary and middle school teachers?

Assertion 1: The greatest differences in beliefs were found during grade level comparisons. These differences in science teacher beliefs were most likely due to the differences in adjustments in content during the science reform required for the two grade levels. The middle school teachers faced a major shift in their content. For most of their careers, the majority of the teachers of grades 6-8 were responsible for providing instruction in one of three content areas: Earth Science, Life Science, or Physical Science. As mentioned previously, the Next Generation Standards in science were organized by the Florida Department of Education into three integrated years of content. All middle school teachers would find themselves teaching from all three of the content areas, most for the first time. The feelings created by this impending change polarized the district's teachers. Based on their responses, some welcomed the opportunity to switch to a more integrated approach. There has been evidence in research that integration is in fact the future of science education as teachers around the country are facing similar transitions. After extensive research into nation-wide science programs and what future practicing scientists would require to do their jobs: "...a general education in the sciences organized along the

traditional disciplinary lines is not adequate for life in the new millennium” (Hurd, p.45, 2000). Despite this, the group of middle school teachers in favor of the science reform was much smaller than those openly opposed to it. Several members of the oppositional group spoke of retirement, others of frustration over the constant trend of top-down changes in curriculum.

With the elementary reform, the Next Generation Standards posed much less of a content overhaul. The basic content remained consistent in grades 3-5 with only a few select topics removed or added. The science reform in this case basically increased the depth to which the already existing topics would be taught. Elementary teachers who were uncomfortable with the reform in most cases indicated that their content knowledge was limited, thus making them unsure of their ability to teach to the required depth. Unlike middle school teachers, these elementary teachers had limited science coursework in their teacher preparation experiences so they often had trepidation as they approached new topics. Also unlike the middle school teachers, the elementary teachers were facing transitions to new standards in multiple content areas, leading to the second assertion which described the most striking differences in beliefs between the grade levels.

Assertion 2: Middle school teachers were more likely to respond that they believed they were involved in the reform process than the elementary teachers who were more likely to believe that they needed more information about the reform. Related to the initial notion that grade level differences are significant and the first research question, this assertion indicated key characteristics of the teachers that are crucial to address prior to implementation of the reform. Despite being only in the planning stages of the reform, many middle school teachers felt that

they were already involved in the reform. Since the Next Generation Standards required a much larger change in content for middle school teachers (from discrete subjects to integrated), they were given opportunities by the district to learn about the standards well ahead of time. Most of the middle school teachers at the time of survey completion had participated in professional development sessions where the transition had been introduced and debated. The standards themselves had been released for public consumption for several months and department chairs at each school had been a part of several monthly meetings dissecting them for further dissemination.

Conversely, at the time of the survey completion the elementary teachers were in the midst of a transition to new standards in Mathematics therefore their professional focus had been elsewhere. The district had not made the science transition a priority at that point as they needed the teachers to grasp the changes inherent in the Mathematics standards. (Since middle school teachers generally are responsible for one subject, the science teachers in grades 6-8 were able to focus solely on science and not have the mathematics changes to concern them.) Select elementary teachers had been a part of monthly meetings to discuss the standards and were asked to bring the discussions back to their schools although they were not necessarily in a position to do that easily. Unlike the middle school department chairs who have structures in place to share information with their colleagues, these elementary teachers return as peers not leaders making it more difficult. The shared concern with reform in other subject areas, and the lack of science specific leadership at the elementary schools seemed to be the keys to the existence of the differences between the beliefs of middle school and elementary school teachers. Once again this assertion reinforced the need for different strategies for implementation of the science reform for

elementary and middle school teachers. Maintaining separate support at the district level for the two grade levels seems critical for ensuring the reform's potential success.

Research Question #2: Did science teachers' beliefs about science reform policies differ between schools based on SES?

Research Question #3: Did science teachers' beliefs about science reform policies differ between schools based on their previous assessment performance?

Assertion 3: Teachers at schools with higher poverty rates and lower testing performance tended to hold more optimistic beliefs about the reform. The implication with this assertion was that teachers at the most challenged schools were more open to change. Taking the *if it aint broke, don't fix it* attitude, it would seem these teachers felt a fix is needed while those at higher performing schools with less poverty did not see the value of change. In fact their responses reflected this with some clarity. Teachers at schools with higher poverty often spoke of the Next Generation Standards creating enthusiasm in their students and creating a more fair assessment environment. While teachers at schools with less poverty frequently referenced their existing success on standardized assessments and their ability to choose what was best for their own students' needs. But success in the district on FCAT was a relative value. The district as a whole had around a 50% passing rate on the 2008 FCAT Science test and even the most confident schools had over 20% of their students not passing the assessment, therefore every school had room for improvement. But many teachers at the higher achieving schools believed that sticking with the content and strategies they already felt comfortable with would make the improvements more likely than starting with something new. This assertion allowed for some insight into the differences based on SES and FCAT but there was still enough variability in the

responses and enough outlier participants (i.e. some teachers at higher achieving schools recognized the value of change while some lower achieving schools were resistant to change) that district providers of support for the reform would be wise to remain flexible with their efforts.

Assertion 4: Teachers were more likely to indicate their beliefs involved personal concerns with the reform rather than concerns for students or managing the reform. While not directly responding to a particular research question, this assertion provided insight into the nature of teachers' beliefs for the study. Research behind the SoCQ (George, et al, 2006) suggested that every participant at the beginning of a reform must first address their personal concerns before moving on to other more external concerns therefore this assertion was not completely unexpected. Teachers had to first contend with how the reform would affect them before they could focus on how the reform would be managed at the school and how it would affect the students. The open-ended items were created to generate responses for all of the possible concerns (teacher/personal, student/impact, and school/management) and participants often expressed more detailed concerns for specific items which correlated with their peak SoCQ score. The majority of teachers had personal concerns and expressed beliefs that the reform would create more work and/or challenge their content knowledge. Slightly fewer teachers with school based concerns expressed beliefs that the reform would encourage/force them to work with other teachers and would require more supplies for new labs. The smallest number of teachers had student based concerns which was to be expected because according to the SoCQ research the teachers would have already processed the personal levels of concern which in the

beginning stages of the reform would be atypical. These teachers had polarized beliefs, some believing the reform would negatively affect their students but others saw the value of the reform for their students. Without experience with the reform, it would seem that the beliefs are based on hypothesized results rather than concrete evidence although some teachers were able to draw from prior experiences with similar reforms in their responses.

The participants in this study represented the entire gamut of schools within the district and reported a wide variety of beliefs concerning the transition to the Next Generation Sunshine State Standards in science. Differences were found based on grade level, SES, and FCAT performance with the greatest differences existing between elementary school middle school teachers. The goal of this study was to use the understanding of the beliefs of the teachers in the district to plan for support for the reform. Overall, it was concluded that it would be prudent to design support for a reform based on grade level, beyond that it would seem that generalizations are harder to make based on SES or FCAT performance so school based considerations may be most effective. Suggestions for the support follow.

The hope was that the data collected would eventually inform a transformational model of reform as suggested by Keys and Bryan (2001) that encouraged understanding the importance of teacher beliefs and acknowledging the potential challenges to science reform. The traditional process of the implementation of reforms had involved defining goals and teacher expectations for a newly designed reform, support provided usually in one-shot events, abandonment of the reform due to lack of teacher buy-in, and adoption of a new reform following the same process (van Driel, et al, 2001). This adopt-abandon-adopt cycle created some of the skepticism seen in

this study, therefore a more reasonable process in adopting a state or national reform with district teachers involved at every step is:

Suggested Process of Implementation of Reform

1. Process and understand the ultimate goals of the reform as written; critical to this is having teachers process the reform, not giving them a filtered version from the district that they feel has already been altered to meet the district's goals.
2. Determine what adjustments (if any) need to be made to fit the needs of the district; critical to this is having logical justifications for these adjustments, not just change for the sake of change.
3. Design a structure to support the reform before, during, and after implementation that uses teacher input throughout; critical to this is on-going site-based professional development that meets the needs of every teacher being asked to implement the reform and involves teachers in the support.
4. Maintain focus on the structure that has been developed despite initial resistance or unacceptable assessment data (particularly standardized assessments); critical to this is understanding that change typically is difficult and although the process may be working data may not initially reflect it so districts and teachers must be willing to invest time into the reform.

The research presented in this study had immediate implications for curricular work as the school district under study implemented its science curriculum reform. As a reminder: “the ultimate goal of any science education reform is the improvement of teachers’ practices and

students' learning" (Bianchini & Kelly, p. 384, 2001). If the district support of the transition to the Next Generation Sunshine State Standards in science followed the recommendations of this study's conclusions, it will find ways to meet the needs of the teachers. District personnel must be conscious of the fact that teachers are ultimately the policy makers in the classroom (Snow-Renner, 2001), putting their beliefs and needs at the forefront of science reform implementation. "Science teachers are being asked to learn new methods of teaching, while at the same time they are facing the greater challenges of rapidly increasing technological changes and greater diversity in the classroom" (Marbach-Ad & McGinnis, p. 158, 2008). In the end, the ultimate measure of success for any educational science reforms is the development of future scientists and the scientific innovations they create. Despite the well intentions of any reform, it may be years or possibly decades before the true effects of any reform are felt. Therefore, it is crucial to set up each reform for success before, during, and after implementation.

Future Research

A research finding that was not part of the original thesis but would be a critical connection for the district to explore further is the inverse relationship between SES and FCAT performance for the schools in the study. As the poverty rates increased, the percentage of students passing the FCAT science test tended to decrease (Fig 8). This distressing trend speaks to the district not meeting the needs of the students in the most vulnerable populations. Of the 34 participants in schools with the highest poverty (47-82% of its students on free or reduced lunch), 25 were at schools with fewer than 45% of its students passing the FCAT science and none had a passing rate over 55%. Conversely, of the 38 participants in schools with the lowest

poverty (8-25% of its students on lunch assistance), 21 were at schools with over 65% of its students passing the FCAT science and none had a passing rate below 56%. This relationship should continue to be explored as the plan for the new standards is developed.

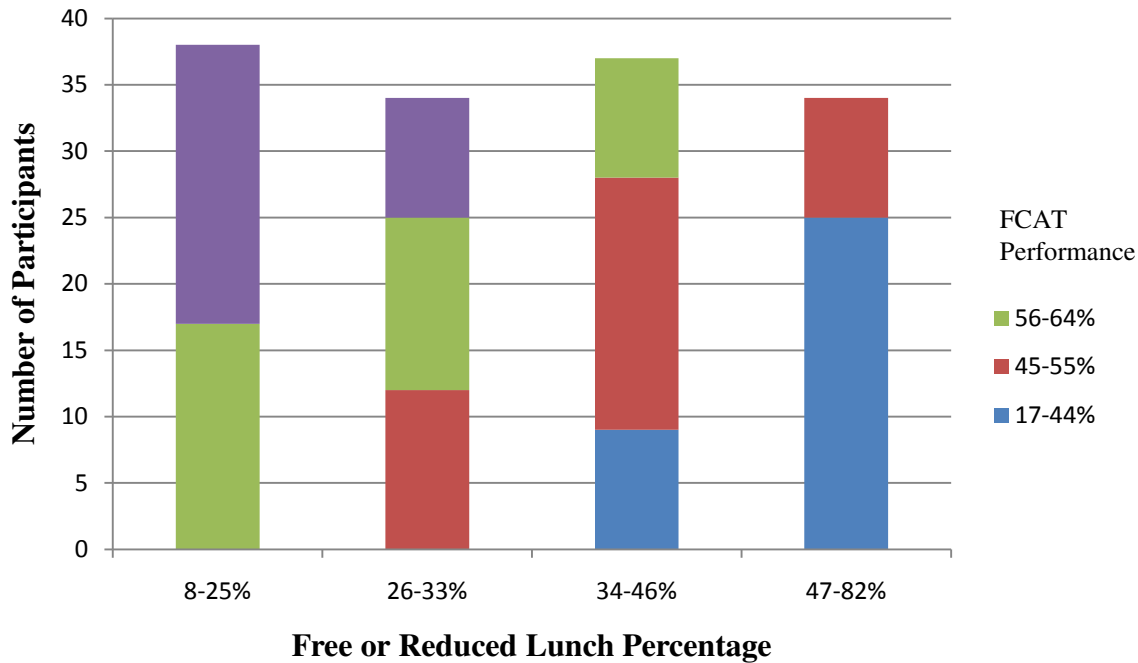


Figure 8: SES vs FCAT Performance for participants

Within the structure of implementation and support that the district develops, serious considerations must be made for adjusting how students in these schools are instructed and prepared for standardized assessments. As mentioned before, although data should not drive the decisions made this clear evidence for current inequalities deserves some further scrutiny as part of the reform process.

In conclusion, this study was able to compare the beliefs of science teachers concerning science reform in the district and unveiled several differences between groups based on grade

level, percentage of free or reduced lunch, and standardized test performance. Suggestions for supporting those teachers based on the findings were provided to assist the district in ensuring a successful implementation of the Next Generation Standards in science. Science reform efforts in K-12 education will continue to be a concern of researchers as long as societal innovations continue to occur. The beliefs of science teachers concerning the reforms will also remain critical as they stand on the frontlines of change and ultimately “it is an individual’s perception that validates truth. People’s beliefs are powerful motivation agents that lead to action agendas” (Lumpe, et al, 2000, p. 287).

**APPENDIX A:
STAGES OF CONCERN QUESTIONNAIRE**

Stages of Concern Questionnaire

*For the purposes of this survey, "Science Reform" is defined as the upcoming implementation of the Next Generation Sunshine State Standards into the K-12 science curriculum.

Name of School	
Grade Level(s) Taught	
Do you teach only science to your students?	

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

Circle only one number for each item

1. I am concerned about students' attitudes toward the Science Reform.	0	1	2	3	4	5	6	7
2. I know now of some other approaches that might work better than the Science Reform.	0	1	2	3	4	5	6	7
3. I am more concerned about another educational reform effort.	0	1	2	3	4	5	6	7
4. I am concerned about not having enough time to organize myself each day.	0	1	2	3	4	5	6	7
5. I would like to help other faculty in their use of the Science Reform.	0	1	2	3	4	5	6	7
6. I have a very limited knowledge of the Science Reform.	0	1	2	3	4	5	6	7
7. I would like to know the effect of Science Reform on my professional status.	0	1	2	3	4	5	6	7
8. I am concerned about conflict between my interests and My responsibilities.	0	1	2	3	4	5	6	7
9. I am concerned about revising my use of the Science Reform.	0	1	2	3	4	5	6	7
10. I would like to develop working relationships with both our faculty and outside faculty using the Science Reform.	0	1	2	3	4	5	6	7
11. I am concerned about how the Science Reform affects students.	0	1	2	3	4	5	6	7
12. I am not concerned about the Science Reform at this time.	0	1	2	3	4	5	6	7
13. I would like to know who will make the decisions with the Science Reform.	0	1	2	3	4	5	6	7
14. I would like to discuss the possibilities of using the Science Reform.	0	1	2	3	4	5	6	7
15. I would like to know what resources are available as we adopt the Science Reform.	0	1	2	3	4	5	6	7
16. I am concerned about my inability to manage all that the Science Reform requires.	0	1	2	3	4	5	6	7

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0	1 2	3 4 5	6 7
Irrelevant	Not true of me now	Somewhat true of me now	Very true of me now

Circle only one number for each item

17. I would like to know how my teaching is supposed to change.	0	1	2	3	4	5	6	7
18. I would like to familiarize other departments or persons with the progress of the Science Reform.	0	1	2	3	4	5	6	7
19. I am concerned about evaluating my impact on students.	0	1	2	3	4	5	6	7
20. I would like to revise the Science Reform's approach.	0	1	2	3	4	5	6	7
21. I am preoccupied with things other than the Science Reform.	0	1	2	3	4	5	6	7
22. I would like to modify our use of the Science Reform based on the experiences of our students.	0	1	2	3	4	5	6	7
23. I spend little time thinking about the Science Reform.	0	1	2	3	4	5	6	7
24. I would like to excite my students about their part in the Science Reform.	0	1	2	3	4	5	6	7
25. I am concerned about time spent working with nonacademic problems related to the Science Reform.	0	1	2	3	4	5	6	7
26. I would like to know what the use of the Science Reform will require in the immediate future.	0	1	2	3	4	5	6	7
27. I would like to coordinate my efforts with others to maximize the Science Reform's effects.	0	1	2	3	4	5	6	7
28. I would like to have more information on time and energy commitments required by the Science Reform.	0	1	2	3	4	5	6	7
29. I would like to know what other faculty are doing in this area.	0	1	2	3	4	5	6	7
30. Currently, other priorities prevent me from focusing my attention on the Science Reform.	0	1	2	3	4	5	6	7
31. I would like to determine how to supplement, enhance, or replace the Science Reform.	0	1	2	3	4	5	6	7
32. I would like to use feedback from students to change the Science Reform.	0	1	2	3	4	5	6	7
33. I would like to know how my role will change when I am using the Science Reform.	0	1	2	3	4	5	6	7
34. Coordination of tasks and people is taking too much of my time.	0	1	2	3	4	5	6	7
35. I would like to know how the Science Reform is better than what we have now.	0	1	2	3	4	5	6	7

Open Ended Questions

*For the purposes of this survey, “Science Reform” is defined as the upcoming implementation of the Next Generation Sunshine State Standards into the K-8 science curriculum.

1. From your perspective, how will the Science Reform affect student learning?

2. Describe what you believe the effect on standardized testing scores will be as a result of the Science Reform?

3. In your opinion, how will the Science Reform affect you as a teacher?

4. What kind of support will be needed in order for you to implement the Science Reform? _____

**APPENDIX B:
THE STAGES OF CONCERN ABOUT AN INNOVATION**

Impact	6	Refocusing	The individual focuses on exploring ways to reap more universal benefits from the innovation, including the possibility of making major changes to it or replacing it with a more powerful alternative.
	5	Collaboration	The individual focuses on coordinating and cooperating with others regarding use of the innovation.
	4	Consequence	The individual focuses on the innovation's impact on students in his or her immediate sphere of influence. Considerations include the relevance of the innovation for students; the evaluation of student outcomes, including performance and competencies; and the changes needed to improve student outcomes.
Task	3	Management	The individual focuses on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, and scheduling dominate.
Self	2	Personal	The individual is uncertain about the demands of the innovation, his or her adequacy to meet those demands, and/or his or her role with the innovation. The individual is analyzing his or her relationship to the reward structure of the organization, determining his or her part in decision making, and considering potential conflicts with existing structures or personal commitment. Concerns also might involve the financial or status implications of the program for the individual and his or her colleagues.
	1	Informational	The individual indicates a general awareness of the innovation and interest in learning more details about it. The individual does not seem to be worried about himself or herself in relation to the innovation. Any interest is in impersonal, substantive aspects of the innovation, such as its general characteristics, effects, and requirements for use.
	0	Unconcerned	The individual indicates little concern about or involvement with the innovation.

**APPENDIX C:
SAMPLE HAND SCORED STAGES OF CONCERN QUESTIONNAIRE**

Stages of Concern Questionnaire

(135)

*For the purposes of this survey, "Science Reform" is defined as the upcoming implementation of the Next Generation Sunshine State Standards into the K-8 science curriculum.

Name of School	
Grade Level(s) Taught	7 Next year 7/8
Do you teach only science to your students? If not, what else do you teach?	yes

0	1	2	3	4	5	6	7
Irrelevant	Not true of me now		Somewhat true of me now			Very true of me now	

Circle only one number for each item

1. I am concerned about students' attitudes toward the Science Reform.	0 1 2 (3) 4 5 6 7
2. I know of some other approaches that might work better than the Science Reform.	0 1 2 (3) 4 5 6 7
3. I am more concerned about another educational reform effort.	0 (1) 2 3 4 5 6 7
4. I am concerned about not having enough time to organize myself each day with the Science Reform.	0 1 (2) 3 4 5 6 7
5. I would like to help other faculty in their use of the Science Reform.	0 1 2 3 4 5 (6) 7
6. I have a very limited knowledge of the Science Reform.	0 1 (2) 3 4 5 6 7
7. I would like to know the effect of Science Reform on my professional status.	0 1 2 (3) 4 5 6 7
8. I am concerned about conflict between my interests and my responsibilities when using the Science Reform.	0 (1) 2 3 4 5 6 7
9. I am concerned about revising my use of the Science Reform.	0 1 2 3 (4) 5 6 7
10. I would like to develop working relationships with both our faculty and outside faculty using the Science Reform.	0 1 2 3 4 5 (6) 7
11. I am concerned about how the Science Reform affects students.	0 1 2 (3) 4 5 6 7
12. I am not concerned about the Science Reform at this time.	0 1 (2) 3 4 5 6 7
13. I would like to know who will make the decisions with the Science Reform.	0 1 2 3 4 5 (6) 7
14. I would like to discuss the possibilities of using the Science Reform.	0 1 2 3 4 5 (6) 7
15. I would like to know what resources are available as we adopt the Science Reform.	0 1 2 3 4 5 (6) 7
16. I am concerned about my inability to manage all that the Science Reform requires.	0 1 (2) 3 4 5 6 7

0	1 2	3 4 5	6 7
Irrelevant	Not true of me now	Somewhat true of me now	Very true of me now

Circle only one number for each item

17. I would like to know how my teaching is supposed to change with the Science Reform.	0	1	2	3	4	5	6	7
18. I would like to familiarize other departments or persons with the progress of the Science Reform.	0	1	2	3	4	5	6	7
19. I am concerned about evaluating my impact on students when using the Science Reform.	0	1	2	3	4	5	6	7
20. I would like to revise the Science Reform's approach.	0	1	2	3	4	5	6	7
21. I am preoccupied with things other than the Science Reform.	0	1	2	3	4	5	6	7
22. I would like to modify our use of the Science Reform based on the experiences of our students.	0	1	2	3	4	5	6	7
23. I spend little time thinking about the Science Reform.	0	1	2	3	4	5	6	7
24. I would like to excite my students about their part in the Science Reform.	0	1	2	3	4	5	6	7
25. I am concerned about time spent working with nonacademic problems related to the Science Reform.	0	1	2	3	4	5	6	7
26. I would like to know what the use of the Science Reform will require in the immediate future.	0	1	2	3	4	5	6	7
27. I would like to coordinate my efforts with others to maximize the Science Reform's effects.	0	1	2	3	4	5	6	7
28. I would like to have more information on time and energy commitments required by the Science Reform.	0	1	2	3	4	5	6	7
29. I would like to know what other faculty are doing in this area.	0	1	2	3	4	5	6	7
30. Currently, other priorities prevent me from focusing my attention on the Science Reform.	0	1	2	3	4	5	6	7
31. I would like to determine how to supplement, enhance, or replace the Science Reform.	0	1	2	3	4	5	6	7
32. I would like to use feedback from students to change the Science Reform.	0	1	2	3	4	5	6	7
33. I would like to know how my role will change when I am using the Science Reform.	0	1	2	3	4	5	6	7
34. Coordination of tasks and people is taking too much of my time to think about the Science Reform.	0	1	2	3	4	5	6	7
35. I would like to know how the Science Reform is better than what we have now.	0	1	2	3	4	5	6	7

Stages of Concern Quick Scoring Device

SoC 075

A Date: _____
 Site: 30 SS#: 135
 Innovation: _____

B

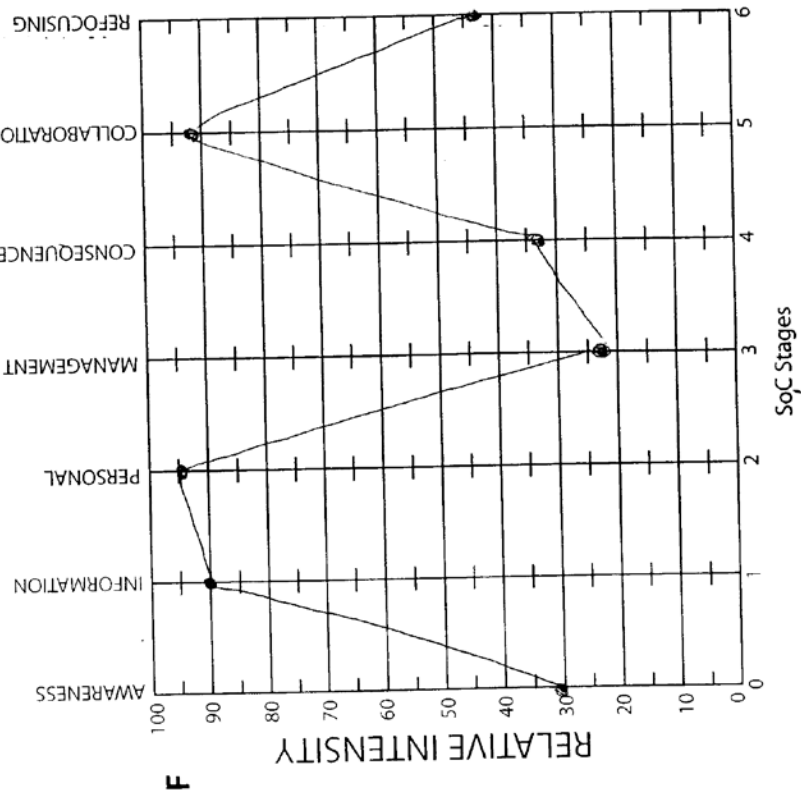
Stage	0	1	2	3	4	5	6
3	1	2	3	4	5	6	7
12	2	3	4	5	6	7	8
21	3	4	5	6	7	8	9
23	4	5	6	7	8	9	10
30	5	6	7	8	9	10	11
1	6	7	8	9	10	11	12
6	7	8	9	10	11	12	13
14	8	9	10	11	12	13	14
15	9	10	11	12	13	14	15
26	10	11	12	13	14	15	16
35	11	12	13	14	15	16	17
2	12	13	14	15	16	17	18
7	13	14	15	16	17	18	19
13	14	15	16	17	18	19	20
17	15	16	17	18	19	20	21
28	16	17	18	19	20	21	22
33	17	18	19	20	21	22	23
3	18	19	20	21	22	23	24
11	19	20	21	22	23	24	25
19	20	21	22	23	24	25	26
24	21	22	23	24	25	26	27
32	22	23	24	25	26	27	28
4	23	24	25	26	27	28	29
8	24	25	26	27	28	29	30
16	25	26	27	28	29	30	31
25	26	27	28	29	30	31	32
34	27	28	29	30	31	32	33

C Raw Score Totals
 E Percentile Scores

Stage	0	1	2	3	4	5	6
Raw Score Totals	7	25	30	7	32	15	42
Percentile Scores	31	94	94	33	93	42	42

D

Five Item Raw Scale Score Total	Percentiles for:													
	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
0	0	5	2	1	1	1	1	0	0	0	0	0	0	0
1	1	12	12	5	1	2	2	2	2	2	2	2	2	2
2	2	16	14	7	1	3	3	3	3	3	3	3	3	3
3	3	4	9	17	9	2	3	5	5	5	5	5	5	5
4	4	7	23	21	11	2	4	6	6	6	6	6	6	6
5	5	14	27	25	15	3	5	8	8	8	8	8	8	8
6	6	22	30	28	18	3	7	11	11	11	11	11	11	11
7	7	31	34	31	23	4	9	14	14	14	14	14	14	14
8	8	40	37	35	27	5	10	17	17	17	17	17	17	17
9	9	48	40	39	30	5	12	20	20	20	20	20	20	20
10	10	55	43	41	34	7	14	22	22	22	22	22	22	22
11	11	61	45	45	39	8	16	26	26	26	26	26	26	26
12	12	69	48	48	43	9	19	30	30	30	30	30	30	30
13	13	75	51	52	47	11	22	34	34	34	34	34	34	34
14	14	81	54	55	52	13	25	38	38	38	38	38	38	38
15	15	87	57	57	56	16	28	42	42	42	42	42	42	42
16	16	91	60	59	60	19	31	47	47	47	47	47	47	47
17	17	94	63	63	65	21	36	52	52	52	52	52	52	52
18	18	96	66	67	69	24	40	57	57	57	57	57	57	57
19	19	97	69	70	73	27	44	60	60	60	60	60	60	60
20	20	98	72	72	77	30	48	65	65	65	65	65	65	65
21	21	99	75	76	80	33	52	69	69	69	69	69	69	69
22	22	99	80	78	83	38	55	73	73	73	73	73	73	73
23	23	99	84	80	85	43	59	77	77	77	77	77	77	77
24	24	99	88	83	88	48	64	81	81	81	81	81	81	81
25	25	99	90	85	90	54	68	84	84	84	84	84	84	84
26	26	99	91	87	92	59	72	87	87	87	87	87	87	87
27	27	99	93	89	94	63	76	90	90	90	90	90	90	90
28	28	99	95	91	95	66	80	92	92	92	92	92	92	92
29	29	99	96	94	97	71	84	94	94	94	94	94	94	94
30	30	99	97	94	97	76	88	96	96	96	96	96	96	96
31	31	99	98	95	98	82	91	97	97	97	97	97	97	97
32	32	99	99	96	98	86	94	98	98	98	98	98	98	98
33	33	99	99	96	99	90	95	99	99	99	99	99	99	99
34	34	99	99	97	99	92	97	99	99	99	99	99	99	99
35	35	99	99	99	99	96	98	99	99	99	99	99	99	99



Concerns Based Systems International

**APPENDIX D:
IRB AND SURVEY PERMISSION DOCUMENTS**



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Expedited Initial Review and Approval

From : UCF Institutional Review Board
FWA00000351, Exp. 10/8/11, IRB00001138

To : Rachel A Hallett and Co-PIs if applicable:

Date : February 11, 2009

IRB Number: SBE-08-05939

Study Title: Science teacher beliefs concerning reform policies: Comparisons between grade levels, achievement history, and socioeconomic status

Dear Researcher:

Your research protocol noted above was approved by expedited review by the UCF IRB Vice-chair on 2/11/2009. The expiration date is 2/10/2010. Your study was determined to be minimal risk for human subjects and expeditable per federal regulations, 45 CFR 46.110. The category for which this study qualifies as expeditable research is as follows:

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

A waiver of documentation of consent has been approved for all subjects. Participants do not have to sign a consent form, but the IRB requires that you give participants a copy of the IRB-approved consent form, letter, information sheet, or statement of voluntary consent at the top of the survey.

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Advise the IRB if you receive a subpoena for the release of this information, or if a breach of confidentiality occurs. Also report any unanticipated problems or serious adverse events (within 5 working days). Do not make changes to the protocol methodology or consent form before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at <http://iris.research.ucf.edu>.

Failure to provide a continuing review report could lead to study suspension, a loss of funding and/or publication possibilities, or reporting of noncompliance to sponsors or funding agencies. The IRB maintains the authority under 45 CFR 46.110(e) to observe or have a third party observe the consent process and the research.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 02/11/2009 04:41:41 PM EST

IRB Coordinator

COUNTY
PUBLIC SCHOOLS

October 7, 2008

Ms. Rachel Hallett
County Public Schools

RONALD L. PINNELL, Ed.D.
*Executive Director of
Secondary Education*

Dear Ms. Hallett:

I am in receipt of the proposal and supplemental information that you submitted for permission to conduct research in the County Public Schools. After review of these documents, it has been determined that you are granted permission to conduct the study described in these documents under the conditions described herein.

Each school principal has the authority to decide if he/she wishes to participate in your study or if it is appropriate to release any requested information. Therefore, your first order of business is to contact the principal of the schools that you wish to involve in your research to explain your project and seek permission to conduct the research at that particular school. You are expected to make appointments in advance to accommodate the administration and/or staff for research time.

Please forward a summary of your project to my office upon completion.
Good Luck!

Sincerely,



Ronald L. Pinnell, Ed.D.
Executive Director
Secondary Education

RLP/jr

TO: Rachel Hallett (Licensee)
County Public Schools

FROM: Nancy Reynolds
Information Associate
SEDL Information Resource Center
4700 Mueller Blvd.
Austin, TX 78723

SUBJECT: License Agreement to reprint and distribute SEDL materials

DATE: September 18, 2008

Thank you for your interest in using the **Stages of Concern Questionnaire** (SoCQ) published by SEDL as Appendix A, pages 79-82 in *Measuring Implementation in Schools: The Stages of Concern Questionnaire* by Archie A. George, Gene E. Hall, and Suzanne M. Stiegelbauer in 2006.

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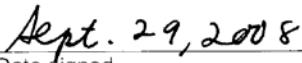
I'm e-mailing you a PDF of this agreement. Please print and sign one copy below, indicating that you understand and agree to comply with the above terms, conditions and limitations, and send the original back to me. If you wish to keep a copy with original signatures, please also print, sign, and return a second copy and, after I receive and sign it, I'll return it with both of our signatures to you.

Thank you, again, for your interest in using the SoCQ. If you have any questions, please contact me at 800-476-6861, ext. 6548 or 512-391-6548, or by e-mail at nancy.reynolds@sedl.org.

Sincerely,




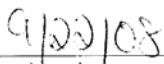
Nancy Reynolds for SEDL



Date signed

Agreed and accepted:

Signature: 



Date signed

Printed Name: 

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