ADDRESSING THE IMPACT THAT WORKSHOP SITE COORDINATORS AND ADMINISTRATORS HAVE ON THE TEACHING OF SCIENCE IN THE CLASSROOM

VALERIE E. MCKENNA
B.S., 1993, University of Central Florida
M.A., 1998, University of Central Florida

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Major Professor: David N. Boote

ABSTRACT

This dissertation studied the beliefs and practices of principals, workshop site coordinators, and science support personnel in two Central Florida school districts and compared those beliefs and practices to the literature on effective science in-service education. It is important to understand these beliefs and practices because they directly affect the content and pedagogical knowledge of classroom teachers, yet this aspect of instructional practices has been ignored in the science education literature. This study used a grounded theory methodology using open-ended individual interviews, participants observation, and documented analysis. Constant comparisons were built through analyzing the data.

The research shows that in-service providers' and administrators' beliefs are aligned with the effective science education in-service literature. The conditions and context are ripe for changes because principals and workshop site coordinators' beliefs are aligned with the literature and changes are already beginning to take place. The intervening conditions may lead to improved teacher knowledge, teaching, and learning because standardized testing is expanding to incoporate the content area of science. Also workshop site coordinators are trying to set up a variety of opportunities to attend workshops on the same topic throughout the school year. Budgets are being restructured at the school level and district level to incorporate more science content professional development. However, it is too early to show how much improvement there will be in standardized test scores or whether teachers' have a deeper understanding of science content knowledge or effective science instruction.

This dissertation is dedicated to my family for all of their love, support and confidence through this process.

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INTRODUCTION

Background and Significance of the Study

Many elementary science teachers are unsure of how to teach science concepts to their students effectively to assist them on their way to acquiring scientific literacy. Recent demands in the past ten years from the Florida Department of Education require teachers to be accountable for the job they do at an even higher level. With the adoption of the National Science Education Standards, State Standards and Benchmarks, and the state mandated Florida Comprehensive Assessment Test (FCAT) over the last decade; teachers are trying to squeeze more content into already tight schedules. The FCAT test is a performance-based test connected to the Sunshine State Standards that are the standards for the state of Florida to be taught in every Florida classroom. In elementary school the FCAT is given in: third grade in Reading and Math, fourth grade in Reading, Math, and Writing, and fifth grade in Reading, Math, and Science. The tests in Reading, Math, and Science consist of multiple choice, short response and long response questions. The Writing test consists of a forty-five minute narrative or expository prompt where the students were asked to write an essay.

There are several approaches to the teaching and assessment of science. One is writing guidelines for what the students should be learning and building upon each year. Another approach the state of Florida has taken is requiring science assessment test to level the playing field so there is testing in other areas besides Reading, Math and Writing. There seems to be a breakdown between the curriculum (standards) and the testing taking place and the assessment test will bring the standards and the testing

together. In 1990, Duschl referred to the fact that science education mainly focuses on the process of justifying knowledge (what we know), but what science education lacks is the process of discovering knowledge (how we know). What we know is found in the science textbooks that are used in the classroom. This requires students to read, understand and obtain the knowledge. How we know is acquired through the active participation in inquiry lessons on a regular basis.

Most teachers attend workshops, take classes, and go to conferences with the intent to become better teachers. However, does attending the workshops, classes and conferences actually help teachers? Boote, Wideen, Mayer-Smith, and Moon (2003) reported that most of the research that has been done focuses on how the in-service intervention affects the beliefs and attitudes of the teachers who attend: however, they do not examine whether or not teachers change their practices because of these interventions. Preliminary studies with the Math and Science Professional Development (MSPD) program show that a small fraction of teachers who attend the workshops feel that it changed their practices. In addition, according to Boote, Wideen, Mayer-Smith, and Moon (2003) in their research regarding in-service workshops, only 4% of the teachers stated that they felt they had dramatic changes in their beliefs and practices based on the workshop they attended. Another 61% said either they had some change or no change in beliefs and 60% said they had either some change or no change in practice. Why is this? There are many factors that contribute to why teachers experienced very little to no change. Reasons for this include already doing hands-on activities, financial support needed, more curriculum planning time needed, or they did not feel that doing hands-on activities was a priority.

Professional development opportunities are crucial for teachers to successfully implement the best teaching strategies for student success. These opportunities include conventions, workshops, institutes, in-service programs and academic coursework. Luft (1999) states that, "Although there is a substantial amount of funding for the improvement of science and mathematics programs in the United States, current in-service practices and classroom impact may be minimal at best" (p. 142). The goal should be to enhance the efforts of in-service professional development for teachers in the area of science. As Beattie (1995) states regarding workshops teachers attend, "More importantly, they have 'the potential to bring new meaning to teacher education and to the continuous experiences of change, of growth and of professional development in a teacher's life'" (p. 65). Teachers have the opportunities to attend professional development workshops to assist with the teaching of science.

Before students can become scientifically literate, the teacher's should challenge their own core beliefs related to the way science is taught through professional development opportunities. Kinchen (2001) states that teachers' core beliefs may act as an impediment to professional development if such beliefs are so rigid that alternative perspectives on classroom practice cannot be appreciated. Science, in many cases, falls by the wayside to other, more significant subject areas such as reading and math, due to the fact that the public and politicians view them to be the two most important subject areas in school.

Teachers need to change their way of thinking when approaching the content area of science. There seems to be a breakdown in science between professional development

and classroom practice. Where does this breakdown occur? Does the breakdown fall on the classroom teacher or does it fall on the administrators and workshop presenters?

Purpose of the Study

The purpose for this study is to better understand the beliefs and practices of administrators, workshop site coordinators, and science support personnel who aid teachers in the classroom. Through this acquired knowledge, the impact on classroom teachers who receive support in various areas will be more deeply understood. Through this understanding, science instruction will be modified to improve student learning.

Research Question

How do administrators and other science support staffs' reported beliefs and practices encourage/hinder improvement in teaching science?

Sub Questions

1. What are principals' beliefs towards science in-service workshops?
2. How well does the design of an in-service workshop fit into good practice models of professional development?
3. How do science support people assist teachers in the area of science on campus or at off-site locations?

This study that was developed represented a grounded theory model. Core categories were created through open coding where a core phenomenon was established. Then a diagram to illustrate the connections to the core phenomenon was made through axial coding when all categories were saturated. Through the research a deepened understanding of the beliefs and practices of principals and workshop site coordinators

with regards to the instruction of science was seen. Insight was gained as to how administrators and workshop coordinators assist teachers in the field of science. The research also developed a better understanding regarding if there was an increase in administrative involvement in preparing teachers to instruct students in science content.

The study investigated how coordinators and administrators assist teachers through professional development opportunities, how professional development is designed to improve/change teachers' beliefs about the content area of science, and how workshops may realign teachers' beliefs about the teaching of science to assist the students in becoming scientifically literate citizens.

Future studies that build on this one may provide a greater understanding of the complexities of classroom instruction in science such as, personal experiences, teacher beliefs, and the effects on instructional practices in the classroom. These studies may include FCAT scores, larger region in the Central Florida area, principal's assistance toward science instructions, and the changes within professional development opportunities in the content area of science.

Assumptions and Limitations

The major assumption of this study is that administrators are doing everything they can to meet the needs of the teachers in their schools so science can be taught effectively with the resources they have; however, principals are limited in some areas because they only have an allotted amount of money from the state to spend. There are also the time limits, meaning they cannot extend the school day except through tutoring opportunities. Another limitation is school culture. In this scenario, students have not developed the basic knowledge and after school tutoring is not an option due to parents not being able to

provide transportation, so this limits these students from receiving the help they need to bring them up to grade level.

Another assumption is that teachers are encouraged by principals to attend professional development opportunities such as workshops, conferences, or other related trainings regarding the effectiveness of science instruction. It is an assumption that these workshops are designed to provide teachers with the best learning situations possible to increase teacher effectiveness in the classroom. Lastly, we assume that, by attending workshops, teachers are trying to increase and deepen their understanding of the science content if this is an area of apprehension for them.

One limitation of the study is that the selection of teachers who choose to or are allowed to attend workshops or conferences is limited. Lastly, there is the possibility of limited support from principals in the content area of science in prior school years before the fifth grade level.

The implementation of the FCAT has encouraged educators and principals to examine the level of learning that is taking place in the content area of science. This investigation will delve into the beliefs and practices of workshop site coordinators, administrators, and science support staff who assist elementary teachers' in the classroom. This topic is an area of limited research in relationship to the improvement of teaching science in the classroom. The collected data provided a deeper understanding of what is being done to assist teachers. Research is crucial to the study of a topic. So analyzing the investigation that has already taken place is our next step in understanding science beliefs and practices.

Definitions of Terms

Actions/Interactions (Instructional Modifications): Changes that are taking place during grounded theory research to strengthen the Phenomenon in grounded theory research.

CIA (Curriculum, Instruction, Assessment) Alignment: An alignment of the science curriculum across all grade levels. This allows students who move within the state to not miss crucial content information. The content is set up to be taught in a particular order and cover specific labs.

Category: Represents a unit of information composed of events, happenings, and instances.

Causal Conditions (Influences): Reasons for change in grounded theory research.

Consequences (Outcomes/Future Needs): The effect the Phenomenon has on the actions, an interaction of a theory creates the outcomes, or future needs in grounded theory research.

Context (Issues): The subject or concern related to the condition, which creates an action or interaction in grounded theory research.

Core Beliefs: The way in which teachers conceptualize the process of teaching and learning and how they view knowledge (their epistemological beliefs).

FCAT (Florida Comprehensive Achievement Test): State assessment test used to identify whether students have met the required standards at various stages of schooling.

Intervening Conditions (Limitations): Items that affect the Causal Conditions and Actions or Interactions in grounded theory research.

In-Service Workshops: Adult learning involves a worthwhile experience that helps one to better him either personally or professionally. Learning may occur due to self-motivation or a requirement of an employer such as the school district.

Paraprofessional: A staff person at the school that is hired to assist teachers with classroom duties such as working with students individually or in small groups, grade papers, file papers, or make bulletin boards.

Phenomenon (Alignment of Beliefs and Practices): The theory that has grown and developed in depth and explanatory power during the grounded theory research.

Professional Development: Opportunities offered to educators to develop new knowledge, skills, approaches and dispositions to improve effectiveness in their organization and classrooms (signifies a commitment to continuous learning, which is a requirement of professionals).

Staff Development: The means by which educators acquire or enhance the knowledge, skills, attitudes, and beliefs necessary to create high levels of learning for all students.

Support Staff: A person hired to assist teachers in the classroom such as a paraprofessional, as well as a media clerk, technology coordinator or, workshop site coordinators.

Organization of the Study

Chapter one will introduce the research problem and the purpose of the study. Chapter two will review the literature available on the topic relevant to the problem being studied. Chapter three will describe the methodology of the study and specific details about grounded research. The grounded research design will be discussed and illustrated

in thorough detail. Chapter four will describe the results of the interviews after they were analyzed and the categories were created. A visual diagram will show the progression of the categories with the phenomenon being the center of the illustration. Chapter five will summarize the results of the research, look at the themes that emerged based upon the results of the data collected, and make recommendations for future research.

CHAPTER 2

REVIEW OF LITERATURE

Background Information

This chapter will look at reform efforts in elementary education in general along with, science curriculum reforms, professional development changes, the impact of high-stakes testing and the application of teacher knowledge in the classroom. Professional development is a common topic throughout the literature; however, it has been more focused on Reading and Writing as will be shown through the literature documented in this dissertation. The chapter begins by looking at educational reform in general and how we are continuously trying to improve instruction to better suit students' needs. In addition, this chapter will look at the historical background of science and how the reforms seem to have made a very small impact on the instruction of science in the classroom with an emphasis on science curriculum in the 1960's – 1990's. Chapter two also discusses the expectations of professional development and what a solid professional development program looks like. Although there are many ways to structure professional development, studies have found specific expectations and guidelines that can create a successful professional development program. The last two sections of the chapter will look at the impact of high-stakes testing and the application of teacher knowledge in the classroom. The studies in the literature shines a light on the fact that very little work has been done connecting professional development to science instruction.

General Education Reform

America is a nation of constant reform in education. The American education community is continuously trying to make better decisions and improve the quality of the

students' education. The belief that the world is constantly changing and jobs are continuously becoming more challenging in the future has not only created the high standards in education that we currently follow, but also is related to high stakes testing and accountability. Standardized testing has many varied purposes. The earliest documentation of testing took place around 1845 when Boston first had short answer questions to assess student learning. At the beginning of the twentieth century, Edward Thorndike created standardized testing to measure students' skills and ability compared to established norm groups. In the latter half of the twentieth century, standardized testing has continued to grow and change. In 1967, Glaser suggested that simply comparing American students to one another were not enough for ensuring achievement in schools. With the publication of *A Nation at Risk* in 1983 and the recent passage of the *No Child Left Behind* Act, the urgency for reform and accountability in education is crucial for the success of all students. Policymakers believe that with high-stakes testing will come good instruction.

In his writing, Goodlad (1964) refers to the fact that to determine what students ought to learn, based on, what is important to that particular content area and what students can learn, causes difficulty with creating the curriculum. We still see this today with the wide spread ability levels in our classrooms. Goodlad felt that the community should take a big part of the responsibility of determining the aims of the schools. Even in the 1960's, the communities did not assume that responsibility. He stated that, "The long-term solution to this dilemma may be that those state and local (and perhaps federal) agencies, that are entrusted with responsibility for the schools, begin to formulate aims. Once this has been done, curriculum groups could go to work to

determine the best curricular patterns to achieve these aims" (Goodlad, 1964/1997, p. 54). The nation does seem to be moving in that direction. Individual states are creating standards and benchmarks that need to be followed to meet national educational goals. From those standards and benchmarks, states are creating high standard rigorous assessment tests to guide the improvement of instruction in the classroom. Gaining support from the communities does continue to be a challenge in regards to implementing the goals the schools want to meet. The changes Goodlad referred to in the 60's are slowly taking place in the content area of science. Education is a preparation for adulthood. We need to make sure we prepare our children. As Bobbitt stated, "Education is primarily for adult life, not for child life. Its fundamental responsibility is to prepare for the fifty years of adulthood, not for twenty years of childhood youth" (Bobbitt, 1924, as cited in Kleibard, 1975/1997, p. 32).

Before students can be successful on assessment tests, teachers need to have an understanding of science content and a belief system that allows them to teach science in the most effective way in their classroom. Taking into account school culture and student needs, during the summer of 1963 a group of writers under the Commission on Science Education for the American Association for the Advancement of Science prepared a teachers' manual and a number of course content outlines in science for early elementary school. "The fundamental assumptions underlying the proposed courses are that science is much more than a simple encyclopedic collection of facts, and that children in the primary grades can benefit from acquiring certain basic skills and competencies essential to the learning of science" (Goodlad, 1964, p. 54). The competencies the students were expected to learn included observation, classification, recognition, and use of space-time

relations, recognition and use of numbers and number relations, measurement, communication, inference, and prediction. The expectation was that, after learning these competencies the ability to use the scientific process would remain long after the specifics in science had been forgotten. The expectations of students are similar today, and issues of how to approach curricular change are like the issues that Goodlad discussed in the 1960's. Curriculum reform disseminated during the 1970's and 1980's. Then in the 1990's reform once again began to slowly progress. The reform continues to take place and we are once again going in the direction that Goodlad felt was important during the 60's to incorporate observation, classification, and recognition back into the curriculum.

Science at times has been sacrificed at the altar of language arts/reading and math but it does not have to be. Science should be used as a vehicle in which science concepts, processes, and skills in reading and math can be developed (p. 1), according to Chris Ohana, (2002) editor of the Science and Children Journal. Through staff development and administrative support, teachers should be able to adjust their beliefs and develop a stronger understanding of the science concepts. An exploration of one's beliefs should be viewed as an essential first step along a pathway of professional development.

Hands-on, real-world experiences that are demonstrated in professional development workshops will provide all students, whether learning disabled or non-English speaking, the opportunity to be successful in actually seeing a concept played out through a lab setting. Making science fun is the key to student success, as well as teachers not only changing their beliefs and attitudes about science but also actually changing the way it is practiced in the classroom. In addition to high stakes testing, other

variables play a large role in the teaching of science. These variables create questions about science instruction that include: 1) Are in-service workshops offered? 2) Once teachers attend the workshops, are they take what they have learned and actually applying it? Do they use the strategies they acquired to improve their teaching of science in the classroom and the students' learning? Do the workshops attended by teachers change their beliefs and perceptions about teaching science? In addition to exemplifying good practices the fundamental role of science teacher educators is to get in-service teachers to think about their own explicit and tacit thoughts about schools, science education, teaching and learning (Craven and Penick, 2001).

Science Education Reform

For the last 40 years, we have seen waves of 'reforms' in science education, yet elementary science education remains for most teachers much the same as it did 40 years ago: dry didactics, textbook-based with some projects. In the meantime, we have changed our views of what science should be and the most effective methods in science instruction. Based on the change of views toward what science should be and the more effective methods that should be used, the big question is: why has the teaching of science not changed nationally?

As early as the 1950's we were seeing a concern with the science curriculum and lack of high school students entering scientific careers. The primary focus shaping science education reform during the 1950's and 60's was the National Science Foundation. Before Sputnik, the NSF's efforts had focused on promoting science fairs, clubs and summer institutes for teachers. Beginning in 1958 NSF increased support for curriculum development at a more rapid pace. They also implemented two programs in

high school chemistry classes. By 1960, these programs represented 42% of the NSF budget (Center for Science, Mathematics, and Engineering Education, 1997). Science curriculum reform programs in the 1960's were designed for the best students to close what was viewed as the technological gap between the United States and the Soviet Union after the launch of Sputnik in 1957. For a brief period from the middle 1950's to the early 1970's, some of the nation's most distinguished professors/scientists left their laboratories/libraries to spend time in the pre-college classrooms. During this time "kitchen physics" for elementary schools was created where students had a specific formula for completing the tasks like a recipe. The collaboration between classroom teachers and research scientists to improve the instruction of science during this time in history was critical to the curriculum reform movement of the 1960's. In Goodlad's studies, he marked the loss of this partnership as one of the major causes of the demise of the sputnik reforms. The moment in history that finally killed the science reform movement of the 1960's was the Apollo moon landing in 1969 according to the Center for Science, Mathematics, and Engineering Education (1997).

By the mid 1970's, the NSF's budget had shrunk to less than 10% and after the election of President Reagan, the program through NSF closed altogether. This created a large educational gap. In the mid 1970's and early 1980's, most of the studies done at this time on teachers' thought processes focused on how teachers managed their classrooms, organized activities, allocated time and turns, and made structure assignments. They also describe praise and blame, formulate the levels of their questions, plan lessons and judge general student understanding (Fang, 1996; McDonald and Elias, 1976; Shulman, 1986a). Shulman (1986) states that the new line of research is

missing issues with respect to teachers such as: “Where do teacher explanations come from?” “How do teachers decide what to teach, how to represent it, how to question students about it and how to deal with problems of misunderstanding?” He feels that the neglected domains of teaching are “the missing paradigm.” Clark and Peterson (1986) stated those understanding teachers’ thoughts and actions should give us a better understanding of how the consistency vs. inconsistency of teacher beliefs and practice interact to increase or inhibit students’ academic performance. In addition, Brophy and Good (1974) stated that a better understanding of teachers’ belief systems or conceptual bases would significantly contribute to enhancing educational effectiveness. Research studies have focused on teacher beliefs and instruction in reading. The research shows that there is an inconsistency between beliefs and instructional decision-making. Due to this, early researchers have discovered that the complexities of classroom life can constrain teachers’ abilities to attend to their beliefs and provide instruction, which aligns with theoretical beliefs (Duffy, 1982; Duffy and Anderson, 1984, Duffy and Ball, 1986; Paris, Wasik, and Turner, 1991; Roehler and Duffy, 1991). Duffy and Anderson (1984) found that, while the reading teachers were able to articulate their beliefs outside of the classroom when it came to instructional practice it was guided more by the nature of instruction and classroom environment. Other reforms include Project 2061, which was started by the American Association for the Advancement of Science in 1985. It calls for educating all the students to become scientifically literate citizens. Being a scientifically literate citizen means equipping people to live in a technologically advanced society where scientific issues are a part of everyday life.

Science reform in the 1990's was back in full swing due to the many studies that had taken place during 1983 with national concern about the poor state of American Education. These studies such as, *A Nation at Risk*, set the direction for new reformers. The reformers felt that the educational challenge of the century was to prepare all children to compete successfully in the increasingly competitive job market. During this time of redeveloping the direction reform was going, NSF funds were once again in effect for science education. The reforms are continuing to emerge. Reformers believe that no teacher can master the changes taking place in society well enough to predict all the skills students need to understand. They must teach them how to teach themselves, to become educationally self-sufficient, and to learn how to learn in the ever-changing society.

Numerous projects are being written today to provide accountability in the education system at the state and national level to improve the standards in the area of science. State level continues to work on the Curriculum, Instruction, Assessment (CIA) Alignment to align the curriculum across the grade levels and the state in science so when students move they are not as likely to miss crucial content information. The standards that have been written at the state and national level are designed to help achieve these goals: however, many educators are hesitant of moving from teaching the "best" students to teaching "all" students. Accountability is also seen in the standardized test (FCAT) given in Florida to assess students in Reading, Math, Writing, and Science. Another area is with the *No Child Left Behind* Act that rates schools with the highest level being "Making Adequate Yearly Progress".

In addition to the complexities of classroom life and accountability, is the fact that teachers need to interact with the students' thinking rather than simply trying to impose order upon it (Bell and Gilbert, 1996). Kinchen (2001a) has argued that learning about student's understanding to inform classroom practice should be seen as an essential component of effective teaching and this can be summarized in a model of teaching and learning the TLC cycle (Appendix B). He feels that this cycle of three interdependent phases can be read in either direction because they are all inclusive of each other. The teaching, learning, and change are constantly being monitored by research and reflection, which is at the center of the cycle. Concrete mapping can be used to illustrate a person's understanding of a topic, such as, science while providing the recording of change and development. Teachers and students can use concrete mapping to show the level of understanding and the quality of the links the individual uses to connect them. The teaching part of the TLC cycle assumes that the students will be constructing meaning from the resources he/she has available rather than simply passed from the teacher to the student. The change part of the TLC cycle is seen through the students' and teachers' learning by changes in their sequences on a concept map. The learning part of the TLC cycle is expected from the students and the teachers. The teachers' learning will be most effective if actively supported by peers and managers. All three parts of the TLC cycle discussed above are supported by research and reflection. If this model is used consistently, an understanding of the teachers' learning style is just as crucial as the students' learning style.

In the past, most elementary science teachers taught as they were taught. Robert Yager (1996), a professor of science education, states at his teacher workshops, "Some of

these people advance clear through graduate school mimicking words that they are taught. When left on their own, they do nothing but recite. They cannot really think" (p. 26). Teachers at the elementary level in the content area of science do not have the ability to think on their own. The material that is used with science curriculum is read from a book and does not need the teacher's deep understanding of the concept being taught. Yager provides opportunity in his district for the retraining through professional development of teachers in science. He envisions a future in which scientific literacy is the norm, where not only scientists but also average citizens understand and use detailed scientific concepts in their everyday lives.

The standards that were created for science are believed to help the push to achieve excellent instruction in the science content area and help students become successful. Teachers of science must juggle many tasks throughout the school day. Teaching science can be one of the most challenging and rewarding jobs in the world. Seeing a student learn a difficult concept or inspiring students to love and pursue science makes the job worthwhile at any level. Student populations are undergoing major changes. Teachers will have a more diverse population in the classroom from ethnicity to mainstreamed students with disabilities.

To assess the understanding of science standards the students will be tested with a standardized test. A large issue that high stakes testing and workshops with pre-service and in-service teachers creates is, are teachers able to do the activity based, hands-on activities in their classroom. According to research by Boote, Wideen, Mayer-Smith, and Moon (2003), to teach science, as an activity-based subject, that most writers and curriculum developers propose is problematic due to conditions, attitudes, and structures

typically present in elementary schools. Some of these issues include, but are not limited to, science not being a subject area of high importance compared to reading and math, lack of time for planning and hands-on lab settings, and teachers who are not open to change. Science is deemed a subject of non-importance in the classroom. Because of this, there are a lack of resources, lack of planning time for science, and lack of time to teach it effectively in the classroom. As stated by Eisner (1978), "When achievement, defined in terms of standardized forms of performance within specific subject areas becomes salient, it is likely that teachers will devote attention to those areas and in the process place less emphasis or neglect entirely areas that are not defined by test performance. What is counted, counts" (Flinders and Thornton, 1997, p. 161, Eisner, 1978, p. 35). With accountability now looking toward science and the barriers that teachers have to overcome in the classroom, will in-service workshops and the science standards guide teachers to change their beliefs and their way of teaching science to better prepare students?

Professional Development to Promote Change

As stated earlier in the chapter providing staff development is important; however equally important is how we evaluate it to see the impact is critical to determine the impact in the school system. "Good evaluations provide information that is sound, meaningful, and sufficiently reliable to use in making thoughtful and responsible decisions about professional development processes and effects" (Guskey, 2000, p. 41). The National Staff Development Council (NSDC) provides guidelines for how to set up professional development, as well as how to evaluate whether the workshops have

created the impact needed. Evaluations provide information useful for designing effective professional development. The NSCD mission statement is:

> Ensuring success for all students by serving as the international network for those who improve schools and by advancing individual and organization development. (Killion, 2002).

NSDC guides workshop site coordinators with their beliefs that include but are not limited to the following:

- Changes create opportunities for growth
- The primary purpose of staff development is school improvement as measured by the success of every student.
- Collaboration within the school community, students, families, community members, and staff is essential for school improvement and accelerated student success.
- All educators share the responsibility for both individual and organizational growth.
- Effective staff development honors differences in learners by using various approaches to learning.
- Effective staff development is based on theory, research, and proven practice.
- Staff development is critical for all those who affect student learning. (Killion, 2002 p. 63).

As stated above, evaluation of professional development is a critical need; however, how to evaluate programs is a challenge to schools and districts. Killion states, "One issue is that they do not know how to evaluate their staff development programs to determine if their efforts influence student achievement. Secondly, *what* they are trying to evaluate is not sufficiently powerful in its design to generate any dramatic, long-term change in teacher practice and ultimately in student achievement." (Killion, 2002, p. 89).

Although it is shown through research that expectations have to be stated up front to be effective, research has shown that few of the staff development programs that were looked at had even identified student achievement as one of the goals. When the goal of student achievement is not stated and learning is assumed to take place, student achievement can be diminished.

In addition, professional developers should be guided by the body of knowledge about how effective change occurs in the education arena. Change is an individual and an organizational reality affecting all educators, as well as the schools, districts, universities and other avenues where they branch out. Evaluations also should be extended back into the classroom to show how the change is taking place. According to research by Loucks-Horsley, Hewson, Love, and Stiles (1998), all educational changes of value require individuals to act in new ways (demonstrated by new skills, behaviors, activities, etc.) and to think in new ways (beliefs, understandings, ideas, etc.).

The understanding of student learning has come a long way over the years; however, equal advances have not been made related to teacher learning according to Anderson and Mitchner (1994). One issue that is looked at is how teachers apply the theoretical pedagogical beliefs they have within the complexities of classroom life is

crucial to address through research studies. Reality imposed on classroom life affects how teachers' beliefs can be played out in the classroom:

> The issue is not whether teachers should possess theoretical [pedagogical] knowledge…They should. Instead, the issue is how teachers can apply theoretical knowledge in real classrooms where the relationship between theory and practice is complex and where numerous constraints and pressures influence teacher thinking (as cited in Fang, 1996, p.59).

In addition, success in the complexity of teaching depends on the collegiality of the teachers within a school. Teachers, who are able to attend professional development and discuss successes, as well as failures, are more apt to continue to go back and try again. The attendance at science workshops creates a learning community of teachers who can collaborate about science instruction. In Luft's (1999) and Little's (1982) research, the findings that included teachers talking, planning and sharing created a strong collegial environment that supported the teachers, offered reassurance to them, renewed confidence, and encouragement to all participants. It illustrated the critical aspect of the success of a professional development program and what the program should look like. These are crucial factors with the professional development being offered.

Summary of Literature Review

For many years, science education has been going through changes and reform. As individual states and the country constantly raise the standards and expectations of the students and teachers, they meet the demands of science education in a changing society. Researchers have spent decades learning about the positives and negatives related to

student learning and how it can be improved. Now they are moving in the direction of studying teachers' understanding and learning. As Kinchin (2001) illustrated in his TLC cycle, teaching requires learning, learning promotes change and change facilitates effective teaching. All three of the TLC areas thrive and improve through the constant research and reflection of the teacher. Whether it is the publications such as *A Nation at Risk* or reforms such as the *No Child Left Behind* Act, National Standards or high-stakes testing, teachers are challenged on a daily basis to improve their students' learning outcomes. This requires them to improve their understanding of the content knowledge the students need to gain and to adopt beliefs consistent with proven practices. They better their instruction based on these guidelines to improve the learning of students. Many variables affect the job of a teacher, however, attending professional development workshops to aide in making changes is crucial to the success of the reform process.

NSDC challenges workshop site coordinators and administrators to create professional development that provides opportunities for growth, to focus professional development on school improvement plans, assist in providing collaboration within school community and district, and provide professional development that honors differences in learners based on theory, research, and practice. Continued challenges arise with evaluation professional development opportunities but are continuing to be looked at and evaluated all the time.

With research comes the process of how the research will be carried out. This study seeks to illuminate the beliefs and practices of administrators and support staff, and determine whether it encourages or hinders the improvement of teaching science. The data collection and analysis will focus on the views of administrators' beliefs toward

science practices in the classroom, the beliefs toward science in-service workshops and the design of the in-service workshops, and how it assists teachers in the changing of their beliefs and practices. The data also shows the ways that science support staff assists teachers in the area of science on campus and at off-site locations. Emerging themes will then be identified and examined. It is only through the data collection and analysis of the data that a clear picture can be presented on how administrators' and support staffs' reported beliefs and practices encourage/hinder the improvement in teaching science.

CHAPTER 3

METHODOLOGY

The beliefs and practices of principals and support staff in the teaching of science content can encourage or hinder the improvement in the classroom. I sought to identify what was taking place in the school systems of two adjoining Central Florida counties. The two counties selected were Orange and Osceola counties. Principals and support staff aided in raising the standards and deepening the understanding of science content knowledge of educators.

Research Design

After the interviews, observations, and follow-up a grounded theory began to emerge. Grounded theory according to Creswell is:

> This situation (grounded theory) is one in which individuals interact, take actions, or engage in a process in response to a phenomenon. To study how people act and react to this phenomenon, the researcher collects primarily interview data, makes multiple visits to the field, develops and interrelates categories of information, and writes theoretical propositions or hypotheses or presents a visual picture of the theory (Creswell, 1998, p. 56).

In 1967, Glaser and Strauss first articulated grounded theory research and they have continued to elaborate on the methodology over the years. However, as recently as the early nineties Glaser launched attacks against Strauss because they differed somewhat in their beliefs about grounded theory. Creswell reaffirms that regardless of how one

approaches grounded theory everyone agrees that, “The centerpiece of grounded theory research is the development or generation of a theory closely related to the context of the phenomenon being studied” (1998, pg. 56). Grounded theory research methods are challenging for researchers because:

- The investigation needs to set aside, as much as possible, theoretical ideas or notions so that the analytic, substantive theory can emerge.
- Despite the evolving, inductive nature of this form of qualitative inquiry, the research must recognize that this is a systematic approach to research with specific steps in data analysis.
- The researcher faces the difficulty of determining when categories are saturated or when the theory is sufficiently detailed.
- The researcher needs to recognize that the primary outcome of this study is a theory with specific components: a central phenomenon, causal conditions, strategies, conditions and context, and consequences. These are prescribed categories of information in the theory (Creswell, 1998, p. 58).

Grounded theory designs have varied over the years, with three main designs used in educational research. The design used in this research is the systemic design. This particular approach to grounded theory research emphasizes the use of data analysis with steps of open, axial, and selective coding and the development of a visual picture of the theory generated from the research. This design was selected because of the structured, detail-driven guidelines for the research. Grounded theorists will use their data to create the open coding categories as shown in diagram. They will select one of the categories to

use as the core phenomenon in the axial coding paradigm. Even though the categories were pre-selected based on the grounded theory model (see Figure 1), the categories created were based on the research through open coding which then fit into each of the predetermined categories in the systemic design created by Glaser and Strauss (1967).

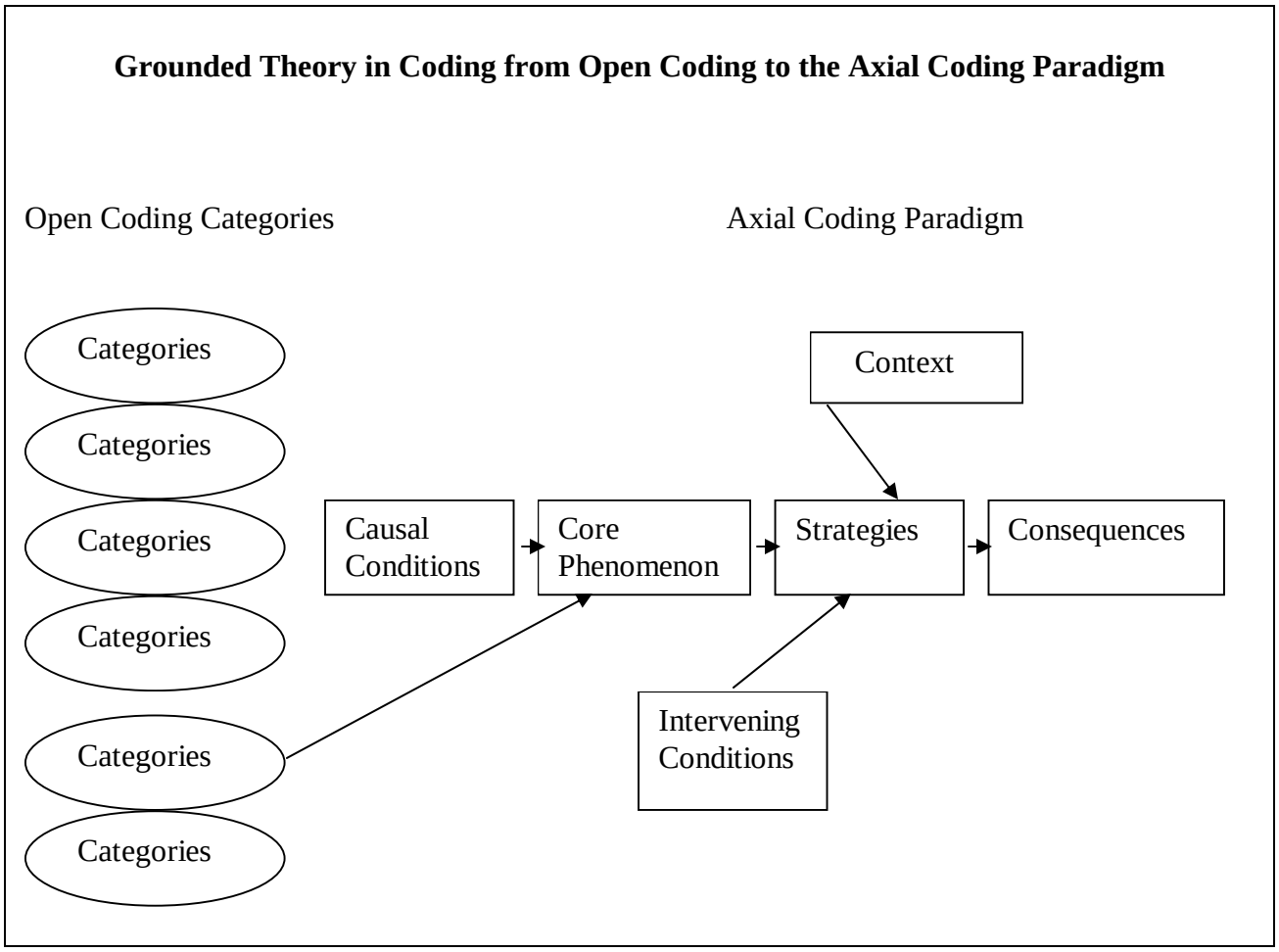


Figure 1: Open Coding to Axial Coding Diagram

Participants

The study began with an examination of science workshop opportunities in two counties. I began by arranging interviews with the workshop site coordinators for each county. I sent out an email to various principals in each county. Each was selected based upon their involvement in science at the county level or involved with science at their schools. The workshop site coordinators for staff development in each county were interviewed and audiotaped. The interview questions were based upon: the workshops offered in each county (see Appendix A); the design of the workshops; the follow-up procedures used after the workshop; and the impact of the workshops. The study also included interviews with selected principals at the elementary level. They were also audiotaped for accuracy and to understand how they were assisting teachers at their schools to prepare the students to meet the standards presented on the FCAT. In addition to coordinators and principals, school-based science lab teachers were interviewed to learn their roles in their schools. I also observed workshops to understand how teachers are being prepared to teach science.

Since the research involved data collection from human participants, the required documentation was filed with and approved by the University of Central Florida's Institutional Review Board (see Appendix D). The sample included two workshop site coordinators, nine principals, and two science lab teachers in two Central Florida school districts. Participation in the interviews was voluntary and confidential. The participants were contacted initially through email (see Appendix E).

The principals, workshop site coordinators, and support staff were located in Orange and Osceola counties, which are two Central Florida counties. Workshop Site

Coordinators were selected because they were the contact people and workshop coordinators for each county. The principals were selected based on involvement with science in the county, and the science support staff was selected based on convenience. Thirteen participants were interviewed. The 13 participants ranged in experience from 5 years to over 30 years in education. The principals were located at the elementary level and the workshop site coordinators were located at the school board office in both counties. The support staff also included employees from the University of Central Florida for the UCF Academy for Teaching, Learning, and Leadership. The research included a new branch of support staff, which includes two classroom teachers who were becoming Science Lab Resource Teachers at their specific schools.

Instrumentation

The individual interviews were conducted with a set of questions created and designed to facilitate and guide the discussion with the researcher and participants (see Appendix A). The interview questions were established as a guideline based on the research questions. The questions were designed based on information gathered from *Mail and Internet Surveys: The Tailored Design Method* by Dillman (2000). I had basic training for creating interview/survey questions through a Qualitative Research class. The interviews were recorded while notes were taken at the time of the interview to ensure accuracy. The tapes were then transcribed and matched with the notes to make sure no beliefs or practices were overlooked. After the transcription process, member checks took place by emailing participants the notes to verify the information that was collected. Beliefs and practices were identified and recorded for each individual. I then compared the two Central Florida counties to describe what was occurring to encourage

or hinder the improvement of teaching science in the classroom. To assure trustworthiness, triangulation was used with information from multiple sources providing the same information throughout the research. These sources included interview, data collection, personal experiences as a teacher within one of the counties interviewed, and observation of the changes within the professional development programs in each county.

Procedures

Data Collection

The data collection process for the study was coordinated initially through the Workshop Site Coordinator for each county and then expanded to reach administrators and Science Lab instructors in designated schools across both counties in 12 different schools. The sampling was done as a convenience sampling, which can limit the research. The sampling identified principals who had a strong interest in science and were willing to participate in the interview, and they may not be representation of all principals. Twenty-two people were asked to participate in the study, with 13 completing the interviews. The emails were sent out the beginning of May 2004 to initially begin to contact the employees of interest. As responses were returned by email, the interviews were scheduled and the consent forms were sent through the school courier or by mail. During the interviews, individuals were assured of confidentiality and encouraged through the guided questions to be forthright in their responses.

Data Analysis

Being aware of the challenges involved in doing grounded theory discussed above, I prepared to complete in-person interviews with individual employees. I completed the

interviews to collect data to saturate the emerging categories. Following the interviews, audiotapes were transcribed verbatim. After the tapes were transcribed and notes from the interviews were compared, the data analysis follow Creswell's model, explained above. During the transcribing of the data, beliefs and practices were identified for each individual. I identified what each county was doing to assist teachers and what changes were already planned to take place during the 2004-2005 school year, based on the implementation of the FCAT science test. I then used an open coding process (Creswell, 1998), to form initial categories about the study by segmenting the data. Through this, categories related to the effectiveness of professional staff development, administrative support and other science-based opportunities were established. The themes were determined by analyzing data into segments, labeling these segments, removing repetitive topics, and narrowing the identified segments. They were also coded into themes that describe how these three parts of workshops, administrators, and additional science opportunities engage and deepen the understanding of the teaching of science. This process was followed by the axial coding process where the data was assembled in a new way.

During the axial coding process I took one open coding category and placed it at the center of the process being explored, which is the core phenomenon, and related each of the other categories that were defined to the core phenomenon. The other categories that were formed were: 1) causal conditions (factors that influence the core phenomenon), 2) contextual (specific issues that cause the actions/interactions to take place), 3) intervening conditions (general limitations that affect the actions/interactions), 4) strategies (actions/interactions that take place in response to the core phenomenon) and

5) consequences (outcomes from using the strategies along with future needs as a result of actions/interactions). After all categories were identified, a coding paradigm (visual illustration), which portrays how each of the categories in the research are connected together (see Figure 1) was formed. When the diagram is viewed from the left side to the right side we can see that the causal conditions influence the core phenomenon that takes place. The phenomenon, context, and intervening conditions then influence the strategies or actions/interactions that took place. Lastly, the instructional strategies affected the consequences that subsequently followed to complete the coding paradigm.

Avoidance of Own Biases

To recognize my own biases, I began by researching my topic and finding out what the research said about professional development in general and then specifically science professional development. Then I wrote about my science beliefs and from where my views and feelings derived. This gave me the chance to write down how I learned science, my beliefs about science teaching, and my training and experiences in science education.

By elaborating on these beliefs first, I was then able to interview workshop site coordinators, principals, and science lab teachers to discuss their feeling, beliefs, instructional practice and background related to the teaching of science. When it came time to do the interviews, I did them able to differentiate my opinion from theirs. This was done so when it came time to analyze the data the participants would be able to present their own voice. During the data analysis, I focused on my notes and recordings. At the end of the interviews, I restated their beliefs from my notes to ensure they were accurate. Then I reviewed the tapes several times to assure that I had accurate

transcription of the cassette tapes. Lastly, when typing I made sure I recorded exact information from the notes and tapes so as not to allow my opinions or biases to filter into the data analysis. The final data analysis provides thorough and accurate accounts of the participants' experiences, beliefs and practices.

Researcher's Background

I have taught elementary education for 12 years: one year at the kindergarten level, seven years in fourth grade and the last four years in fifth grade. I served in several capacities in each of the three schools where I have had the opportunity to work. I served on the Technology Committee 11 of the 12 years assisting teachers with various areas of technology in the classroom. I served as Science Liaison to the Orlando Science Center for five years. After the connection with the Science Center ended, we continued to have a science committee in which I have had strong leadership. We began a combined Math/Science Night in primary and intermediate grades for parents to come with students and participate in various math and science activities throughout the school. I served as Grade Chair/Team Leader two years at two different schools. During my third year of teaching, I began my Masters Degree in Math, Science, and Technology through the Lockheed Martin UCF Academy. There I continued to grow and improve my own teaching of math and science, as well as, the use of technology across the curriculum. Science continued to be an integral part of my teaching through workshops, conferences and working at the Orlando Science Center Summer Camps for two summers. In 1999, I was recognized as a National Board Certified Teacher in Middle Childhood/Generalist.

At the elementary school where I work, we continued to work on building up our science curriculum with the implementation of the FCAT test. We gather, organize and

order materials needed for Curriculum Instruction Assessment lessons. We also organize bins for each unit so materials are always together which makes it easier to gather and buy all the resources needed for a unit. The organization of the units, which I lead on our grade level, has saved each of us hours of time so we can spend it planning for other activities.

Due to my enjoyment of the science curriculum, I have consistently been involved in a variety of ways to influence and improve the teaching of science. Due to the deeper understanding and involvement with the science curriculum that I have, I attempted to avoid preconceived opinions and biases I have regarding the teaching of science in the classroom. Through the interviews, I wanted to portray the workshop site coordinators, administrators, and science lab teachers' perspectives of science and allow their beliefs and practices to speak for themselves.

My Personal Experience with Science

I have always had a love for science. I do not know exactly when or how it started; however, it was crucial in my growing and learning experiences. I also feel educating students is important in developing a love for science. I will look back to when I first began using science.

I was extremely inquisitive as a child. I always wondered why things happened the way that they did. I do not remember formal science lessons during elementary school but I do remember situations where the class had questions about various topics. We would create mini experiments to find out the answers. In fourth grade, a solar eclipse took place while school was in session and we wanted to watch it. We talked about what an eclipse was. In addition, we addressed how we could not look at the sun. My fourth

grade teacher allowed us to make papers that would show the shadow of the sun on the ground as it changed. Then we discussed what took place after it was over. It had a strong impact on me. As I grew older, I felt that the hands-on lessons were most memorable because we investigated and created the lessons ourselves.

In addition, in middle school we had the opportunity to dissect a frog. I definitely was a bit squeamish about completing this activity, however, I know I would not have understood the lesson as well if we had just read about it in a book and looked at pictures. These days' students can use computers that introduce or review studies on frog dissection. They can even label the parts themselves.

My love of science continued into high school where I took Biology, Earth Science, Chemistry, and Marine Biology. All of the above classes were hands-on with labs in each class. These classes continued to encourage and enhance my love of science. Up until my junior year in high school, my enthusiasm and love of science led me to an interest in Veterinarian Medicine and Marine Biology. I did change my major of interest to elementary education my senior year in high school but maintained my love of science through the years by teaching science, as well as summer jobs at SeaWorld for seventeen summers and the Orlando Science Center for two summers.

As I shared my expertise and love of science as a summer camp teacher at the Orlando Science Center for two summers, I was able to incorporate the same ideas into mini one-week sessions on a given topic for students. It was a very intense program but the students asked many questions and got many answers in return. The process helped to create more questions for them to investigate on their own. Through my love of science, I provide not only my students with appropriate science lessons but I also work

with the administrators, science lab teachers and grade level teachers, and paraprofessionals to help develop their understanding of the importance of science in the classroom. We also help to develop ways we can work together to improve all students' learning and understanding of the science content through our growth and depth of understanding related to science curriculum.

In my own teaching, in which I have primarily worked with fourth and fifth graders, we have used science as a major part of our learning to connect science and math. We have investigated the solar system, the ecosystems, force and motion, the human body, and flight along with other small units the students had an interest in learning about through science content. We participate in at least one lab per week. We begin with a question, which the students or I create. We then investigate the question through research and find answers, which often creates new questions. Through this approach, the students develop a curiosity and love for research.

Through my own growth and development as a student and then a teacher, I feel that teachers and administrators have been there and supported me to learn more about science. I have never had a fear of science due to the support I received when I was a student along with pursuing my teaching degree. I also have been self-motivated in continuing my education in the content areas I teach to my students. I have continued my own education by completing my Master's Degree in Math, Science, and Technology for Elementary Education and attending workshops on a regular basis. Even though I feel that I have a deep understanding of the teaching of science and have always been willing to assist others, I wanted to learn how I could teach the lessons better. The administrators I have had the opportunity to work with have always allowed me to pursue my interest

and love of science to better prepare my students for the real world. The workshops I have chosen to attend have always been beneficial to me. I was pleased to see that both county and local administrators believe that workshops do not end at the conclusion of the professional development opportunities. Follow-up is adding a new dimension to the workshops attended by having additional resources, write ups to complete, questions to answer, and collaboration with colleagues that also attended the workshops.

CHAPTER 4

The purpose of this study was to examine the beliefs and practices of the workshop coordinators, principals, and science support personnel who support teachers in the classroom. I used a grounded theory approach to complete the study, using a diagram (see Figure 2) to show how the changes in science instruction were implemented and what were the outcomes of these changes. The diagram also shows future changes that may take place due to influences and issues in the area of science.

This study was designed to answer the following research question:

How do administrators and other science support staffs reported beliefs and practices encourage or hinder the improvement in teaching science?

Sub Questions

1. What are principal's beliefs towards science in-service workshops?
2. How well does the design of an in-service workshop fit into good practice models of professional development?
3. How do science support people assist teachers in the area of science on campus or at off-site locations?

Data Analysis

During the data analysis phase of the research, I used Creswell's (1994) approach to grounded theory analysis. As I describe the stage of the data analysis, I will show how I used grounded theory to interpret the data (see Figure 3). After I transcribed the interviews for the workshop site coordinators, administrators and science support personnel, I read the information and coded items that were relevant to my study. I omitted information that was not pertinent to the study. Then I began to organize the data

and make memos or notes in the margins to begin the open coding process. Through the open coding process, I was able to ascertain the themes. After examining the codes, I then listened to the tapes a second time to identify the categories that appeared.

The themes and categories were cross-referenced and the themes fit into the five categories of Glaser and Strauss (1992) diagram. The categories in grounded theory were then labeled with the core categories emerging in my research. These included: 1) causal conditions (*influences*), 2) context (*issues*), 3) intervening conditions (*limitations*), 4) actions/interactions (*instructional modifications*) and 5) consequences (*outcomes/future needs*). These categories each affect the change in the improvement of science instruction that needs to take place in the content area of science. From these four categories emanated the central phenomenon, which was alignment of beliefs and practices.

> *The workshop site coordinators, administrators, and science support personnel understood the changes that needed to take place to create a more successful science program in their county and individual schools. It would also meet the rising demand for understanding science at a deeper level by teachers and students.*

The following diagram shows the relationship among the categories within the research and how each of categories fits together and affects the others.

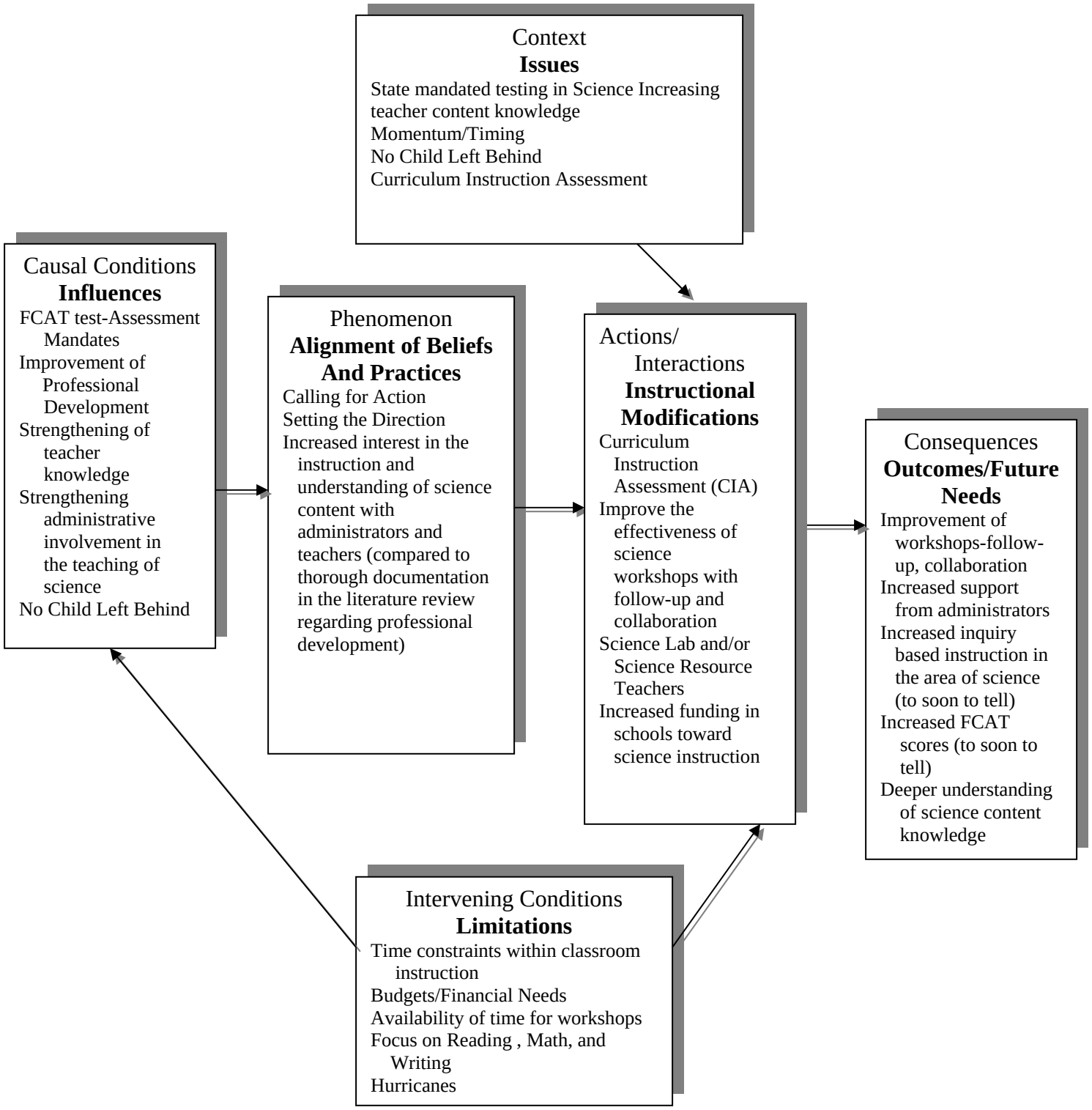


Figure 2: Core Categories

Coding Categories in Research by Glaser and Strauss

Coding

Categories	Sources
Influences	
FCAT-Assessment Mandates	L
Professional Development Improvements	L, 1, 2, 3, 4, 6, 7, 8, 9, 10, 13
Strengthen teacher knowledge	1, 2, 3, 4, 6, 9, 10, 12, 13
Strengthen administrative involvement in teaching of science	O
No Child Left Behind	L
Alignment of Beliefs and Practices	
Call for Action	L, O
Setting the Direction	L, O
Increased interest in the instruction and understanding of science content with administrators and teachers	3, 4, 6, 8, 9, 10, 11, 13
Issues	
State mandated testing in science	L, O
Increasing teacher content knowledge	2, 5, 6, 7, 8, 9, 11, 12, 13
Momentum/Timing	2, 5, 7, 12
No Child Left Behind	L, O
Curriculum Alignment Initiative	L, O
Intervening Conditions	
Time constraints within classroom	1, 4, 6,7, 9, 11
Budgets/Financial Needs	3, 6, 9, 10, 12, 13
Availability of time for workshops	1, 2, 3, 4, 5, 7, 11, 13
Focus on Reading, Math, and Writing	1, 2, 3, 4, 6, 8, 9, 10, 11,12, 13
Hurricanes	

KEY

\# Interview
L Literature
O Observation

Figure 3: Coding Categories

Coding Categories in Research by Glaser and Strauss

Coding

Categories	Sources
Instructional Modifications	
Curriculum Instruction Alignment	L, O
Improve the effectiveness of science workshops with follow-up and collaboration	1, 2, 3, 5, 7, 8, 10, 11, 13
Science Lab and/or Resource Teachers	2, 4, 5, 10, 11, 12, 13
Increased funding in schools toward science instruction	Too soon to tell
Outcomes/Future Needs	
Improvements of workshops-follow-up, collaboration	
Increased support from administrators	
Increased inquiry based instruction in the area of science	Too soon to tell
Increased FCAT scores	Too soon to tell
Deeper understanding of science content knowledge	Too soon to tell

KEY

\# Interview
L Literature
O Observation

Figure 4: Coding Categories

Causal Conditions-Influences

The sub heading *influences* falls into the category of causal conditions. One of the influences is the state-mandated FCAT assessment test. Students are required now to take this in elementary school at 5th grade in science, which will count as part of the school grade beginning in 2006. The state uses FCAT performance scores to determine the grade a school will receive based on student progress during the school year. Another influence is the improvement of professional development in both counties, which are restructuring at this time. An important outcome of improving professional development is the strengthening teacher knowledge and administrative involvement in the teaching of science. Both are part of the conditions that influence the changes that are taking place.

Workshop Coordinators

According to Loucks-Horsley, Hewson, Love and Stiles (1998), "The reform of mathematics and science education rests firmly on a commitment to change the form of teaching and learning that is currently the norm in our nation's classrooms" (p. 7). They also argue that, "teachers play an essential part in achieving this vision in the classroom. Although there are many factors in educational environments that hobble good teachers, without major change in typical teaching the vision of a reformed education, will evaporate" (Loucks-Horsley, et. al. 1998, p. 7). Professional development offers opportunities for educators to develop new knowledge, skills, approaches, and a disposition to improve their effectiveness in their classrooms and schools. This signifies a commitment by the teacher to continuous learning, which is a requirement of professionals. For teachers to continue to improve the effectiveness of teaching in the classroom, experiences have to be provided and implemented for the teachers to grow

and change their views. Loucks-Horsley, et. al., referred to the fact that outstanding science and math teachers have a special kind of knowledge that is enhanced through professional development.

The workshop coordinators in both counties felt that the FCAT test was playing a significant role focusing science education change. "The FCAT is forcing us to realign the teaching practices in the workshops and the follow-up that is taking place," stated one workshop site coordinator. When both county workshop site coordinators were interviewed, the concern was more with the follow-up than with the workshop itself. Both counties offer hands-on inquiry-based lessons. Both counties try to provide resources that teachers need, though money runs out toward the end of the year. Both workshop site coordinators agreed that they would like to be able to provide the teachers with all supplies for all activities taught in the workshops, such as books and materials. Orange County definitely feels that follow-up is the "weak pin" with the workshops and is continuously working on creating more effective activities to extend the workshops back to the classrooms. The workshops in Orange County now have resources online (eg. lesson plans, books), to encourage additional readings after the workshop, collaboration with other teachers whether they are at schools or other locations, and communication with the presenter of the workshop. Additionally, workshop site coordinators are willing to meet with teachers individually to assist with the instruction of science. Osceola County's workshop site coordinator feels that teachers' weakness with science is, "being overwhelmed by materials needed and the workshops the teachers attend can't supply enough of the materials to help them." These limitations on workshops and resources will be discussed in more detail below.

Principals

The principals that I interviewed were selected due to their direct involvement in science, whether at the county or school level. Not all of them had a love of science, but they knew it was an important content area on which to focus. The focus has been enforced, based on what principals said due to the push of the *No Child Left Behind* Act and the FCAT, which now includes science. The principals know that the workshops teachers attend need to be effective. One principal stated, "Workshops should not be one-shot wonders!" Similar statements were expressed by most of the principals interviewed. Principals are becoming more aware of the expectations for science content. Through professional development, as discussed by one principal, "we are trying to create a safe place, where teachers are allowed to explore, practice their skill, collaborate with colleagues, and make sure that what is being learned is grounded in solid content."

Influences Summary

The five identified influences drive how the teachers and administrators in these two counties are approaching science education reform. Such items guide them as the FCAT test and the *No Child Left Behind* Act. Beyond these reforms educators wanted to improve. They know science is important and are moving to make the changes necessary to improve the instruction of science. Workshop Site Coordinators and Administrators have strong feelings about the influences that take place related to science instruction (see Figure 4) and are fairly, knowledgeable about the impediments to that improvement. From these influences developed the core phenomenon, which is the alignment of their beliefs and practices.

CAUSAL CONDITIONS--INFLUENCES

#1-“Professional development needs to be long term. Coaching, co-hort groups, and lesson studies need to be an integral part of the professional development.”-Workshop Site Coordinator

#3-“The most effective professional development is ongoing, not a one shot deal.”-Adminstrator

#6-“In regards to professional development teachers need to have a balance of background content, hands-on, and demonstration lessons to take back to the classroom. Teachers also need to receive resources, books, and material.” –Workshop Site Coordinator

#10-“Professional development should be ongoing and experienced multiple times. It also should include collaboration with all group members.”-Administrator

Figure 5: Influences-Interview Feedback

Central Phenomenon-Alignment of Beliefs and Practices

The *alignment of beliefs and practices* phenomenon was driven by the causal conditions. The causal conditions created a call for action and set the direction of the changes. An increased interest in science instruction has been created even though much of the literature on instructional change focuses on reading and math instruction. This caused my participants to assess and align their beliefs and practices with the new expectations of science education.

Workshop Coordinators

The workshop site coordinators in both counties had 23 and 24 years of experience, respectively. They have each taught a variety of grade levels and subjects and feel strongly about getting teachers the assistance needed at their schools. The beliefs and practices of both workshop site coordinators directly focused on how they could affect the students. The Orange County workshop site coordinator stated, "Students need to have a curiosity about science, be able to observe, and look at things with skeptical, questioning, excited eyes." Osceola County's workshop site coordinator paralleled many of these ideas, adding the importance of making sure the activities in the classroom were hands-on and provide real life applications. Both coordinators echoed that, "With science content we need to encourage students to ask 'why' and develop a plan to find out why things are the way they are." Through focusing on students, they want to increase teacher knowledge by providing workshops and resources for teachers. They would support classroom teachers making sure they are meeting the expectations for students.

Principals

Principals also showed that their beliefs and practices are focused in the right direction--to improve the instruction of science. Their focus stems from the question stated by an Orange County principal, "Are students getting what they need in the classroom to understand inquiry?" The principals' goal is to make sure that students are thinkers, that they want answers to questions about the world around them, that they understand how things work, and that they are able to find answers to questions. An Osceola County principal felt that, "science is an opportunity for students to stretch beyond their normal realm of thinking, grow to make connections, build foundations for other learning and thinking and truly understanding the concepts and not regurgitating the information from a text book." Through preparing students, the principals look towards the teachers and how to better prepare them to meet these needs and expectations for the students. "Teachers need to learn with the students, use all resources available to them and constantly model to the students," said an Orange County principal. Principals provided opportunities to attend workshops to increase content knowledge. Some were offering workshops at on-site school locations while others were allowing teachers to attend trainings at both county offices. "Effective in-service for teachers includes teambuilding, ongoing collaboration, groups at the school level, continuing to practice, reflecting and research. The strengths from this include more focused small group interaction which increases the impact at a deeper level," says another Orange County principal. These ideas show how the beliefs and practices of principal's are important in moving forward and improving the instruction of science in the classroom.

Alignment of Beliefs and Practices Summary

Alignment of beliefs and practices are seen through the research (see Figure 5). Workshop site coordinators and principals were actively aware of the right ways to assist teachers and were striving to achieve those actions based on their beliefs and practices. The coordinators were aiming to improve professional development in the areas of weakness and provided as many teachers the opportunity to attend the trainings as possible. The crucial issue of follow-up is being fine-tuned in both counties and structured to benefit teachers in the long term. Principals were working to encourage teachers to challenge themselves in the area of science, expand their knowledge and share their learning experiences with their colleagues. They were also working to provide science resource teachers and/or science lab teachers to assist in the learning process of teachers and students.

PHENOMENON--ALIGNMENT OF BELIEFS AND PRACTICES

#3- “Students should know the scientific process through the experiments done in class. The students should constantly ask ‘why’ about things in the world around them. Everything is tied to parents’ involvement so we have a Science Night and a Science Fair to encourage parent participation.”-Administrator

#4- “Through science instruction students should participate in hands-on lessons involving the scientific process to help organize their world. The students should develop process skills through problem solving and lab experiences. Connections need to be made through science content to the real world.”-Administrator

#6- “The students should learn the Big Ideas in Science and be taught to pay attention to the process through observation and data collection. The students need to participate in real life, hands-on activities that help them develop the understanding of the reasons why things are the way that they are.”-Workshop Site Coordinator

#8- “Students should be thinkers who want answers and aren’t afraid to ask why. They should develop the understanding of how things work and how to find answers.”-Science Lab Teacher

Figure 6: Alignment of Beliefs and Practices-Interview Feedback

Context-Issues

The context section of the model, *issues*, describes the factors that affect the central phenomenon of *alignment of beliefs and practices*. These issues include state mandated testing in science, how to increase teacher content knowledge, the *No Child Left Behind* Act, the Curriculum Alignment Initiative in Florida and the constant issues of momentum and time that teachers face each school year.

Workshop Coordinators

Workshop site coordinators were aware of the pressures that the FCAT, *No Child Left Behind* Act and the CIA program put on teachers. They were striving to achieve a professional development program that would prepare teachers to better teach science. Orange County is working to provide Wednesday afternoon workshops where the teachers would have a "one-cluster" focus on a "strand" of weakness from the initial assessment test. The one cluster focus for the 2004-2005 school year was Ecosystems where each workshop that was offered throughout the year related to Ecosystems. The workshop site coordinator states, "They plan to meet six to seven times during the school year to increase the content knowledge of that particular strand of science content." She feels that the workshops "should be ongoing" and that "the content should be experienced multiple times." Osceola County is continuing with their workshops during the school year. The workshop site coordinator feels that, "teachers experience what will happen through doing activities and being required to take the lessons back to the classroom." Both counties continue to challenge teachers to bring a friend who has not been before to the workshop. However, there is only a limited amount of space in each workshop so it is difficult at times to allow everyone to come that wants to attend.

Principals

Principals were most concerned at this time with the state mandated testing in science, and with preparing the teachers to teach science. One principal in Orange County stated, "Teachers teach to their strengths. We need to make sure we broaden their strengths." Principals were also extremely aware of the time constraints that teachers are under, trying to fit all content material into the student contact time. They understood the importance of attending workshops and immediately coming back and implementing what was learned with students. Many of the principals interviewed provided teachers with the opportunity to share a science activity that was taught in the classroom that the students really understood. They also allowed teachers to present workshops to demonstrate lessons that went well in the classroom to encourage other teachers to try them. An Osceola County principal stated that he "is aware of the pressures for the fifth grade teachers in teaching science and trying to expand the inquiry experience of science content knowledge across all grade levels." Principals are facilitating the expansion of science inquiry across both counties in all elementary grade levels.

Issues Summary

State mandated testing in science is a concern with both workshop site coordinators and administrators. Making sure that teachers are prepared with the knowledge and resources that are needed to be successful is of utmost importance to both groups (see Figure 6). Curriculum Alignment in Florida and the *No Child Left Behind* Act are critical as well, but were not mentioned very often even though the impact on science in the classroom is great. Increasing teacher content knowledge was discussed in detail by both groups

whether at school or at an off-site location. The momentum and timing of the workshops is crucial, the workshop site coordinators felt, to assist as many teachers as possible. If teachers have too much time back in the class before a lesson(s) is taught it may never be.

CONTEXT--ISSUES

#2- "Teachers need to have in-depth content knowledge with an intense follow-up component."-Administrator

#5- "Teachers need help to feel more comfortable doing science lessons with kids. The important factor is to teach teachers first and then the teachers and then allow students to get immediate practice with students."-Administrator

#7- "Teachers need more time to plan and discuss content material with colleagues."-Administrator

#8-"Teachers need to understand the difference between how they learned science and how to teach science. Lessons need to be experienced rather than just talked about."-Science Lab Teacher

#9- "With state mandated testing and the push for the implementation of science, teachers need to be able to know how to integrate science into reading and math."-Administrator

Figure 7: Context-Issues

Intervening Conditions-Limitations

The influences for change and the instructional modifications we make to create change are always met with *limitations*. Limitations included time constraints with classroom instruction, budgets at the local and state level, financial needs of each individual school, the focus on reading, math, and writing, availability of time for workshops and severe weather (hurricanes).

Workshop Coordinators

Along with strengths come weaknesses or areas that are continuing to be evaluated. In Orange County, the "weakest pin" would be the follow-up, and that is an area that is looking to be modified this year with "more thorough follow-up after workshops." According to the workshop site coordinator, "The follow-up also includes continuous study of the same strand throughout the year to encourage the same teachers to come back each time and bring someone with them to increase the knowledge and encourage more teachers to transition to an inquiry based science classroom." This school year the strand of learning included Ecosystems. Osceola County also has weaknesses that it is assessing in the area of science instruction. At the county level they feel that, "the largest weakness is the lack of funding to be able to provide teachers with a resource or some of the materials needed when they leave a professional development training." They also feel that, "the teachers are overwhelmed by the amount of materials that are needed for each lab." Workshop site coordinators plans were affected a great deal this year because of three large hurricanes that hit the Central Florida area, which put the schools in both counties being out approximately three weeks of school total. These days were made-up in both counties by taking away early release Wednesday, which is when the students get

out an hour early so teachers can attend professional development workshops. Other days were made-up on teacher workdays where professional development training was to take place so it limited the opportunities for teachers to attend the science workshops that were offered by the counties. The changes that were to take place this school year could not necessarily be fully implemented with the workshops due to the many changes in the school calendars for both counties.

Principals

Principals feel that "not enough money is provided for professional development nor for the materials and/or resources that are needed to help teachers at the school level or county level through training." One principal in Orange County also felt that "it was difficult to get teachers to commit to science professional development. They were limited in the number of teachers that were allowed to attend." For example, one principal created an environmental site that students can attend during the school year. During the summer, the site has been used for training teachers who then turn right around and work for two weeks with students at the environmental site. However, the grant will only allow for seven teachers per summer to attend, which makes it a lengthy process to have many teachers attend this excellent hands-on training. This feeling resonated with several other principals. Other weaknesses, as stated from one principal and repeated by others was that, "They were limited on the professional development workshops that were able to be offered at the school level due to the amount of money available for these opportunities and the cost of the experts to come out and present." Principals also felt that "a one-time workshop on a topic at the school or county level was not very beneficial to the teachers, and that half day planning should be funded to discuss

content for the teachers across all grade levels." This is a practice, however, that can, be funded at individual schools depending on where they are able to get the money. Another weakness with professional development according to an Orange County principal is that "the time of day the training is offered is difficult for some people to attend. Time of implementation is crucial. If there is not a follow-up and the materials are not easily accessible, the teachers will put off doing the lesson and continue teaching the way they were before. Connections with students will not be made to see the impact of a different teaching style approach." Lastly, another statement that was made by principals and science lab teachers is that "the teachers are asked to attend professional development on their own time with very little praise/value for attending. Points are given for the workshops however, principals are concerned that once teachers have received the points needed for re-certification the drive is not there to continue to attend since the professional development is not mandatory and very little is received from attending." Teachers need 120 points in five years to renew their teaching certificate in Florida. Many teachers can receive 120 or more points per school year depending on the professional development they attend. Some teachers will continue to attend workshops whether they need the points or not but there are many teachers who focus on the points needed for renewal and once that is complete they will attend as few additional workshops as possible especially since most workshops do not offer a stipend (monetary payment) for attending.

Limitations Summary

The design of in-service workshops is crucial to their success. Both counties were extremely aware of the negatives and working to improve those areas. Evaluation being

the “weak pin” in Orange County has provided them opportunities to try several different approaches for follow-up and collaboration among teachers. As the issues are worked out, teachers will meet colleagues at other schools where they will be able to collaborate and discuss what worked and what did not to improve the effectiveness of science instruction. Evaluation of workshops, effectiveness of administrative practices and providing science resource teachers for faculty and students is taking place in both Central Florida counties. Many opportunities are being provided for teachers to develop a deeper inquiry science classroom. Another limitation that came about this particular school year, which the counties had no control over, were three hurricanes that hit the Central Florida area and caused many missed days of school. Due to the days off, workshops had to be cancelled and the school hours had to be made-up. As a result, we lost Wednesday early dismissal (where students get out of school an hour earlier for teachers to attend trainings and workshops) and many workshops and trainings were put on hold. Budget funding was a constant concern mentioned by all employees interviewed. The focus continues to be on reading, math, and writing in the classroom. Students are being retained in grades three through eight if they do not pass the state test in reading. The struggle continues to be overcoming the limitations to meet the needs of the students in science (see Figure 7).

INTERVENING CONDITIONS--LIMITATIONS

#3- “The biggest weakness is that there is not enough money to purchase the materials and resources needed to teach science appropriately.”-Administrator

#6- “Teachers are overwhelmed by materials needed for labs and the workshops can supply enough of the materials.”-Workshop Site Coordinator

#9- “School funds are used for county workshops. It would be more beneficial to use them at each individual school site.”-Administrator

#11- “The time the workshops are offered is difficult for many teachers to attend. Other workshops such as reading and math take priority over science workshops, which can create scheduling conflicts. Also, the timing with implementation is crucial and if the strand learned about isn’t being taught there is lag time between when it’s learned and when it’s implemented in the classroom.”-Administrator

#12- “There is very little emphasis on science, so more support and funding is needed. The situation is also a political issue.”-Science Lab Teacher

Figure 8: Limitations-Interview Feedback

Actions/Interactions-Instructional Modifications

Instructional modifications are the crux of whether the changes in science instruction will take place. The modifications that workshop site coordinators, principals, and teachers make will create avenues for change to move forward. The impact of the changes might be seen in the near future.

The most important factor in all of the science learning is the children. When interviewed, the workshop site coordinators, principals, and science lab teachers had varying terminology for students' skills yet it all was for the same purpose. All participants said, "Science should be hands-on and integrated." Some other phrases used to describe the students and science included: not as much textbook, higher-level thinking, processing skills, fundamentals, experiences, channels curiosity, exciting eyes, developing a curiosity and teaching children how to observe. All participants were excited to discuss this topic. Science is an area that creates thinkers and students who want to find answers to questions. Students need to be able ask the question, 'why,' about all topics and then be able to figure out how to find the answer. An administrator stated, "Teachers need to present students the Big Ideas of science where connections are made across all content areas, such as Cycles. Students need to see the relationships between the cycles in the study of weather, rocks, and life." Developing the ability to see these connections will be taught through asking questions, research, observations, and collecting data. The students will learn to be aware of the process at hand in each situation. Providing students with the inquiry-based experiences in science opens up many more opportunities and paths for students to take when they get older. It ignites the

interest of becoming a scientist and encourages more girls to take an interest in math and science.

Workshop Coordinators

According to Loucks-Horsley, et. al., (1998) in regards to the design of professional development, "No matter what the design for a professional development initiative or program, several issues must be addressed if learning is to occur and be maintained over the long haul" (p. 191, 1998). The issues they felt needed to be addressed were ensuring equity, building a professional culture, developing leadership, building capacity for professional learning, scaling up, garnering public support, supporting the standards and frameworks through professional development, evaluating professional development and finding time for professional development. All nine issues are things that have been addressed by both counties. Science workshops are designed in both counties to be, "hands-on lab trainings for teachers to learn and become more comfortable with" according to workshop coordinators. Orange County was focusing one strand of weakness, Ecosystems, at the Wednesday workshops that were being offered throughout the year to continue to reinforce the knowledge level. Daylong workshops were also offered at each grade level to focus on various strands of knowledge throughout the year. Osceola County offers similar workshops to their teachers. The strength in both counties included supporting the standards and frameworks through professional development and building a professional culture. The largest weakness of the nine issues listed above seems to be finding time for professional development especially since both counties lost Wednesday afternoon early dismissal because of bad weather. The second weakness is evaluation of the professional development. Both

counties said, “they were in the process of improving the evaluation of professional development opportunities but knew that it was still an area of weakness. Points are earned from attending staff development opportunities. Evaluation can be done online, and the remainder of the points for the workshop can be earned when the evaluation/follow-up is completed. This evaluation/follow-up can include answering questions about workshops, completing on-line chat sessions over a period of a few weeks, reading resources and/or collaborating with other teachers. The follow-up of the workshops I have attended this year have illustrated the changes that are taking place within Orange County. It is crucial for workshop site coordinators to make sure all nine issues have been addressed because “each of these issues is important, and lack of attention to any one of them can doom a professional development initiative from the start” (Loucks-Horsley, et. al., 1998, pg. 191). Changes are being made to professional development constantly to improve the effectiveness of the content material shared. Both counties seemed to be aware of what was working and what was not. They did everything within their means to make an effective professional development for teachers to attend.

Many changes are taking place in the content area of science at this time due to the implementation of the FCAT science test. Both Central Florida counties are assessing what is working with professional development in the given counties at the county and school level. The research shows that both Central Florida counties acknowledge what appropriate professional development looks like and with the implementation of the FCAT are working to provide teachers with the opportunities to change their views and/or improve their teaching. Orange County, at the district level, is

going to provide Wednesday afternoon workshops for the teachers to attend. It begins during the 2004-2005 school year based on one given strand. They will consistently provide activities related to a strand of science that was the weakest on the preliminary tests of the FCAT. The workshop site coordinator believes that, "Professional development is ongoing and it has to be experienced multiple times." She believes that "students should develop curiosity about science, see it through observation, be skeptical and question what is taking place, and view it with exciting eyes. They also need to have many people participate who have a love of science and want to improve, as well as, teachers who do not feel as comfortable with science as others." When teachers do not feel as comfortable with the inquiry-based teaching of science it makes it difficult to convince them to come out and participate in the workshops provided. The workshop site coordinator felt that the, "Follow-up is crucial however, it is the "weak pin" in the program." They are aware of the need for change and are working to revise the workshops with increased collaboration of teachers during the workshops. This will then continue when teachers return to the classroom environment and follow-up will take place back in the classroom with the workshop site coordinator.

Osceola County is taking a slightly different approach, however. It is still working to better the education of the students in the classroom, as well as, improve teachers' comfort level with the teaching of science. Osceola County workshop site coordinator expresses that they "find teachers with an interest in science at each school" and they "will train them to be science leaders at their schools. Through this process other teachers will have a contact person at the school, which hopefully will be encouraging to others and light a spark of interest in them to learn about how to improve their teaching

of science." Osceola County workshop site coordinators and administrators also realize that, "Professional development is not a one shot deal. The teachers need to be able to collaborate with others, the training should be ongoing, and a strong support network needs to be created." An area of weakness for the county has been being able to provide the resource books/materials needed to promote success due to lack of funds. The workshops that were provided include a balance of background content, hands-on demonstration lessons and a resource book and/or materials when possible.

Along with professional development specific to each county, the University of Central Florida had the opportunity through a grant to offer Mathematics and Science Professional Development (MSPD). This was offered through the University of Central Florida's Academy for Teaching, Learning and Leadership and the College of Education faculty. This was offered to many school districts across the state, learning communities, schools, and individual teachers throughout the state. The professional development opportunities expanded to include summer institutes to teachers using the MSPD curriculum modules that had content rich instruction through the specific content. The MSPD workshops were a four-day, 30-hour institute that taught using the constructivists' model. Constructivists believe that each child can learn the scientific process in a rather straightforward manner by observing patterns and making predictions. The workshops included investigation stations and many opportunities for reflections. The workshops had follow-up support to help teachers increase their content knowledge and build the competence and confidence in teaching math and science. The MSPD workshops are an excellent opportunity to build a community of colleagues to collaborate over a four-day period. I feel like I left the training with a deeper understanding of the content and how

to develop an inquiry-based classroom. The grant was funded from the Florida Legislature through the Florida Department of Education. Research on this project shows that the more than 7,400 teachers who attended these workshops, between 2000-2004, showed significant gains in their content knowledge of the math and science. When tested in the specific content areas the research also showed that students of these teachers did statistically better when compared to the students of teachers who did not attend the professional development.

Principals

At the school level, principals are using science teacher experts in the regular classroom, lab teachers, or science leaders to provide professional development. One Orange county principal says that they "are looking at the weaknesses in science and creating professional development around that area at their individual school. The teachers will choose the particular staff development they would like to attend. Teachers with great scores and a love of science will be given the opportunity to teach workshops and share their expertise." I have had the opportunity to share with my grade level and the faculty exciting new ideas we are trying in my classroom the past two years. Principals are also encouraging teachers to try new ways of teaching science, and teachers are being rewarded with praise and recognition for doing so. One principal created the PLUNGER award for a teacher who had tried something new in their classroom related to science and presented it to the faculty at a meeting." This principal wanted to strongly encourage his staff to try new things knowing that change was difficult for everyone. They are also having the workshop site coordinators from the county come out and do training with the teachers. Principals also realize the importance

of professional development being an ongoing process throughout the year and not a one shot deal as stated by all participants. A way to increase the love and understanding of science is to bring back Science Night to encourage parents to become more involved and develop a deeper understanding of science content. Science Fairs, where the students create big research questions and test their hypothesis, are also being implemented. Along with the research, the students will create a presentation to share their findings. The presentations can be done at the school level and as the trend grows, include a county competition.

Principals assess teacher performance in science in several different ways. They can observe in the classroom, which with science is a very effective way to understand how the teacher is doing with science instruction. Science should be an "extremely involved process and seeing that process take place with teacher and student interacting in the classroom is crucial to its success," according to principals in both counties. At the faculty meeting, one principal honored teachers each month that had tried something new in their classroom. This reward encouraged teachers to step outside their comfort zone, try an inquiry-based lesson with the teacher as facilitator, and then share the positives that took place. In addition, several principals with the implementation of the FCAT are looking to provide more in-house workshops for teachers in the area of science and they are relying on experienced science teachers to assist in this area. They follow up with collaboration of teachers and share successes that have taken place in the classroom. As the year progresses, they hope to have more teachers volunteer to present and share ideas through trainings. Principals also assess by checking lesson plans on a regular basis. Teachers were asked to record benchmarks in lessons to show that lessons tie to the

standards that need to be covered during the year, along with accommodations and modifications for special education students. They also looked to see how often lab experiences take place in the classroom setting at the elementary level. When very few labs were recorded, teachers were encouraged to attend trainings. They were assigned a mentor teacher whose expertise is in science to assist in lesson planning and making a smooth transition to inquiry-based learning. The principal's look at FCAT scores to assess how teachers and students perform on the state mandated assessment test. The test provided principals "data to see where weaknesses are for individual classes and the school as a whole. These can and should be a guide for the following year for Professional Growth Plans, which each individual teacher is required to do and the Professional Development Plans that the school works on to assist with providing professional development opportunities to improve in particular areas of need." Lastly, principals encouraged teachers to attend professional development in-house and countywide. They even encouraged them to continue their education in the area of science. For example, the Lockheed Martin/UCF Academy is a very strong Math, Science, and Technology Masters Degree program. In the two-year program, teachers learn how to improve teaching in those three academic areas with a cohort group of teachers. Recent research regarding this program has shown that Lockheed Martin Scholar graduates who have remained in the classroom show higher student test scores in the areas of math and science compared to non-graduates, which is a strong statement for the program.

Principals in Orange County are looking to enhance the way science is taught at the elementary level. They are aware that teachers are not as comfortable with science as

other academic areas in some cases. They are working to assist teachers to deepen their knowledge level and build a strong comfort area for the teachers. The principals interviewed had eight to twenty years of experience and the love of science and/or promoting the improvement of teaching science. One principal's specialty was not science, however, she said, "My ability to want teachers and students to do their best encouraged me to surround myself with people whose expertise lay in the area of science and could help find ways to improve the students' learning." The principal had a paraprofessional that assisted the teachers in gathering the materials that they needed for each experiment. The paraprofessional had a school credit card for purchasing science materials so teachers could complete the labs. The materials were in a container outside the classroom the day the teacher was to teach that lesson. This is not the norm at most schools, however, this principal was meeting the needs of the teachers so they could "focus on the instruction of the science curriculum rather than focusing on gathering the materials needed for the experiments." This particular school site, as well as, several other schools in the county has created a science lab with a certified teacher to focus on the area of science. This lab is attended one or two times in a five to sixteen day rotation for 40 minutes at a time depending on the number of students in a particular school where the students receive supplemental Science instruction to deepen their understanding. It was made extremely clear by the principals and science lab teachers interviewed that "the labs were not a substitute for concrete inquiry based lessons in the classroom but a supplemental resource to assist the teachers."

Support for teachers include grants for training and materials needed for science to be most effective. Teachers across the county are encouraged to go to science workshops

offered during the school year. They are not mandatory but teachers are encouraged to go and can earn a varying amount of points depending on the length of the workshop or training to put toward their re-certification which has to take place every five years with 120 points earned or two college level classes. Many schools in both counties are implementing or continuing to have the students participate in Math and Science Nights for parents and students along with including Science Fair again at the elementary level. Students and parents are encouraged to participate in both events to provide more learning opportunities for the students.

Osceola County is training science lead teachers who will work at the elementary schools in the county. They will attend two training sessions during the summer and will focus on understanding and practicing science inquiry. They will also do research and read information text. A contact person from the district will come out to the schools to visit classrooms, observe, and conference with teachers. They will meet with principals to discuss goals for the year in August and do demonstration lessons in classrooms from August-November. There will be meetings for three full days with teams throughout the year and teammates will have the opportunity to observe each other.

Science Support Personnel

Teachers who have a love of science are beginning to move into leadership positions at various schools. In Orange County, three of the participants are science lab teachers. Their principals have selected them to be a part of the Special Area rotation where students attend Art, Music, and PE. The students will attend the Science lab one to two times during a specified rotation of the schedule depending on the number of students attending the school. One of the science lab teachers worked at a school with a

little over a 1,000 students and she was on a sixteen-day rotation. The lab teacher saw them two consecutive days every sixteen days. Another science lab teacher was able to see her students every ten days due to having a smaller number of students during the rotation. One of the experienced science lab teachers stated that, "Teachers that consider science as one of their areas of weakness need to develop the skills set with math and science content knowledge to be able to guide the students in the discovery of knowledge. Teachers developing a fuller understanding of the content material that needs to be presented to students needs to take place and with the Science lab teachers at various elementary schools they will be able to assist teachers in the lab environment along with being an on-site daily resource for teachers if needed." Schools are also using these teachers to present workshops at school sites to build the collaboration and unified understanding of the science curriculum.

Osceola County is in the process of training a teacher to become an "in-house expert" at each school. This teacher will go to trainings provided by the county but they will remain at the individual school to assist teachers as needed. According to the workshop site coordinator for the county, "The expert will do professional development training for teachers, collaborate with teachers on each grade level--along with facilitation connecting the grade levels together--and develop the enhancing spectrum to have an easy flow from one grade level to the next." These science leaders will also, "assist with gathering materials, modeling lessons, and providing resources for teachers." The science leaders will ultimately be in the schools to encourage the other teachers and light sparks of interest for others to develop a deeper understanding of science content and the most appropriate ways to facilitate learning in the classroom.

Instructional Modifications Summary

Principals and other science support staff showed that their beliefs and practices ultimately encouraged the improvement of teaching science in the classroom (see Figure 8). The principals were providing the support to the teachers by creating science lab positions, allowing teachers to attend conferences and/or workshops, hosting workshops at the school, and even going above and beyond, as one principal had done to provide a paraprofessional to gather and prepare science materials for the science labs the teachers were doing. The paraprofessional was given a credit card to go to the store and purchase science materials needed which relieved the stress on the teachers so they could enjoy teaching the scientific inquiry lesson.

Principals were definitely supportive of teachers attending conferences or workshops, however, the cost for substitutes and/or registration to the workshops was limited, especially if it happened toward the end of the school year. Principals' beliefs definitely affect classroom teachers' practices. If the principal is supportive and open to new ideas and creating new ways of presenting science, the teachers are more open to making the changes also. Change is never an easy process, but if every opportunity is given to the teachers they are much more receptive.

Science support staffs at on-site locations are there to provide assistance and reinforce what was taught in the classroom to prepare students for the FCAT test. The schools that have them in place will be ahead of those that are not in strengthening the knowledge the students have going into the test. Science support staffs at off-site locations provide workshops for teachers to strengthen their knowledge base to share with students and other colleagues in the school setting. In-service workshops are

continuing to be redesigned to benefit the teachers involved and strengthen the knowledge they obtain when attending the workshops and building the collaboration needed across the counties to deepen the understanding of science content knowledge.

ACTIONS/INTERACTIONS-INSTRUCTIONAL MODIFICATIONS

#1- “As a Science Resource Teacher I meet with teachers and collaborate with teachers on a regular basis to help strengthen classroom practices.”-Science Lab Teacher

#2- “My job is to create a safe place where teachers are allowed to explore, practice their skill, collaborate with colleagues, and work in grounded solid content.”-Workshop Site Coordinator

#6- “Providing a Science leader in each school and then build the other teachers knowledge base from there.”-Workshop Site Coordinator

#10- “Administrators are using Science Specialists through departmentalizing grade levels in fourth and fifth grades and/or Science Lab Teachers to assist the teachers through teaching students science in a lab setting during special areas rotations.”-Workshop Site Coordinator

Figure 9: Instructional Modifications

Consequences-Outcomes/Future Needs

Outcomes seen through the research included improvement of the follow-up and collaboration in science workshops and increased support from administrators. *Future needs* are increased inquiry-based instruction in the area of science, increased FCAT scores, and a deeper understanding of science content knowledge by the instructional staff. The future needs are areas that we may see results from in the near future, however, at the time of the research it was too soon to tell.

Workshop Coordinators

The improvement of workshops is an ongoing process. Both counties recognize the weaknesses in their programs and are working to create better follow-up after the workshop is over rather than them being a "one-shot deal." They are also trying to obtain money through grants and other resources to continue providing teachers with the resources they need to be successful. Osceola is continuing to offer trainings for science support personnel for each school.

Principals

Principals are adding areas of aid at their schools to increase support of teachers in the area of science. They realize the importance of supporting teachers. Many of them are expanding the areas of assistance to include a more focused support with the teaching of science. Specific trainings were being offered at the schools to assist teachers. Support personnel were being hired to provide additional help for students and the ability to collaborate with teachers to increase content knowledge.

Member Check

After the initial interviews were completed, the data was analyzed and recorded. A follow-up was conducted with interview participants. A memo designed to illustrate the major findings in the study was created. Questions were generated to be a guideline for facilitating feedback regarding program implementation, success or failure of programs. Also it looked at what changes the workshop site coordinators, administrators, and science support staff would make now or when FCAT scores count toward school grades and the level that accountability would rise, to include another content area.

Seven out of thirteen participants provided feedback regarding the memo. Four principals responded. One principal stated that, "The science lab she had created provided hands-on experiences that was often missing in the classroom because of other pressures. Our school was participating in the SMART grant for science and math. The facilitators said that the baseline data definitely proved the advantage." A second principal had a very similar statement. He felt that the programs they were implementing were successful and the students loved science more than ever. He felt that "probably no changes would need to take place because they have patterned their science lab to model the science test and are getting positive feedback about the program." The third principal works in a science magnet school and she feels that "they are already aligned as best as we can to the concepts tested." The principals seemed to feel extremely confident in research results as well as being accountable in the area of science beginning in 2006.

Two workshop site coordinators offered feedback in regards to the memo. University of Central Florida's Mathematics and Science Professional Development is building institutional affiliations with schools, learning communities, and districts to

provide fee-based professional learning experiences based on scientific research related to knowledge and pedagogy. These workshops were designed using the field-tested MSPD curriculum modules that offered content-rich instruction through subject specific pedagogy, problem solving in mathematics and inquiry in science. The 30-hour institutes had imbedded follow-up, which included reading resources and have been shown statewide to improve student achievement by increasing teacher content knowledge, competence, and confidence in math and science. She stated that, "The primary focus of the MSPD-2 Collaborative program was to invest in site-based teacher-leaders, district Leadership Teams, Curriculum Resource Teachers, and Learning Resource Teachers. We expected these leaders to facilitate staff development for their own colleagues, build a network of learners and strengthen capacity within the school focused on increase student achievement."

In addition to these workshops, the university brought in nationally recognized experts to provide quality professional development focused on relevant, research based topics that would influence student achievement. The second workshop site coordinator stated that regarding the impact of "counting" FCAT scores she believes, "content-based professional development in science will increase in part because the accountability will reach a new level, and in part because more money will be earmarked for Science Professional Development." Another strong statement she made was: "We need to be cautious, however, because until science FCAT scores count in determining school grades, the urgency will not be as high as it is for mathematics, reading, and writing." These feelings show that we seem to be moving in the right direction with providing

appropriate Science professional development and with FCAT scores counting beginning in 2006, there will be a strong increase in Science content professional development.

One science lab teacher included a response to the memo. The science lab position she felt was successful "in the respect that all children (1050) were provided with science experiences that were both inquiry and standards-based." Due to the new position, she did not offer as many professional development opportunities as she would have liked, but hopes to begin implementing them next school year. This year, the limitations were "only seeing the students a maximum number of eighteen times. It limited how I designed my lessons and, due to storage space, I was also limited in saving student work over a long-term period." She also referenced the MSPD-2 workshops that were being instituted at various schools across the state. Training was being done this summer to the Education Development Center in Boston to provide support for MSPD coaches that were already in place. She felt that "it had been a struggle getting districts to buy into sending teachers to professional development for science and math. The literacy series has been very popular and districts could see the value when it had reading tied to teachers' growth." In view of the FCAT, she does not think that she would change the way she teaches science. She does feel that classroom teachers would feel the impact of actually having to allow time to teach science content. As the scores begin to count, she strongly feels that "districts leaders will be scrambling for more assistance in providing professional development for best practices in science education. So the approach districts are taking is not pro-active at all. It will definitely be re-active!"

Outcomes/Future Needs Summary

The findings show that principals and other science support staffs' reported beliefs and practices encourage the improvement of teaching science. Principals seem to always be encouraging teachers to attend professional development to improve knowledge in any area of deficiency whether it is located at their on-site location or at an off-site location. Principals who are motivated to help teachers improve their ability are going to increase the effectiveness in the classroom; however, there are outside forces such as funding, time, and resources that continue to have an impact on the increased depth of knowledge.

Science support staffs are challenging teachers to meet the needs of the students, whether it is workshop site coordinators, a science lab teacher, or a science lead teacher. Science lab teachers and science lead teachers are at the schools to provide immediate assistance for teachers on a daily basis. Some Orange County schools have hired a certified classroom teacher to be a science lab teacher and accommodate additional student needs through a lab setting class during special area rotation. They also provided support for teachers through answering simple questions they may have or provided professional development opportunities for the teachers to strengthen their content knowledge. Osceola County schools are training lead teachers to be at each school as a resource for teachers to come to whenever needed and provide the additional support that they need to improve the teaching of science in the classroom. Math and Science Professional Development (MSPD) is being offered by certified teachers through the University of Central Florida for teachers to attend for a weekend to strengthen their knowledge of inquiry-based science through various strands of science content. Even though it does cost the participants to attend, many teachers want to improve the

effectiveness of their science instruction and continue to attend even if the sum is paid out of their own pockets.

In-service providers and principals' beliefs were aligned with the literature on effective in-service. The conditions and context are ripe for changes in the intervening conditions that may lead to improved teacher knowledge, teaching and learning.

Contradictions

Through the research there were no contradictions found. All opportunities given to teachers were moving toward modified professional development opportunities that are designed to provide teachers with the most effective learning environment with structured follow-up to strengthen the knowledge gained.

New Issues

New issues that have arisen are continuous evaluation of the new programs that are being implemented in both counties. The professional development opportunities and training for teachers need to be assessed periodically throughout the year as well as a final at the end of the year to find out how the impact has affected classroom teachers the first year. Changes need to continue to be made to enhance the professional development training for teachers in the coming school year. In addition, the FCAT science test will begin counting toward school grades in the next year or two. Workshop site coordinators and principals will need to look at the strands that are the weakest and focus on improving teacher understanding and student comprehension in those areas to continue to bring up those scores. Another issue that was shown was the limited ability to provide enough professional development opportunities and training for many teachers, who need strategies, practice and collaboration with colleagues. This will deepen their scientific

understanding and confidence level to create the inquiry based classrooms. With funding continuing to be limited, professional development opportunities with small numbers are common and are not able to be repeated several times for other teachers to have the opportunity to attend.

CHAPTER 5

Professional development research has been taking place for many years. The direct impact, however, on the instruction of science is a relatively new topic of research. Most research has focused on professional development in the content areas of reading and math, and most studies of in-service have only looked at the changes in teachers' beliefs. My literature review did not identify any studies of the beliefs of in-service providers.

This chapter will discuss the results, including recommendations for workshop site coordinators, principals, and other science support staff related to their reported beliefs and practices. It will also discuss how they are encouraging or hindering the teachers' improvement in teaching science. It will conclude with recommendations for future research.

The purpose of this study was to understand the beliefs and practices of principals, workshop site coordinators, and science support personnel in two Central Florida counties who support the teachers in the classroom. Through the knowledge that the research obtained, the impact on classroom teachers who receive support in various areas was more deeply understood. I hoped to find that workshop site coordinators and principals were making the needed changes to affect the instruction of the science curriculum.

Using grounded theory, I asked questions in individual interviews of workshop site coordinators, principals, and science support personnel. Through the interviews, categories were created which I reported to illustrate the changes taking place with science in-service education. The categories included: 1) influences, 2) issues, 3)

limitations, 4) instructional modifications and 5) outcomes/future needs. All participants could clearly explain their beliefs and practices. These explanations showed that they understood the importance of training and developing teachers' understanding of science content. They also understood what needed to be done at the county, school and classroom levels. However, due to the intervening conditions, which were discussed, their beliefs were not always implemented effectively. Many principals felt that they were implementing the changes they were able to in the circumstances. Because of time limitations with the school day and other academic instruction, budgets and financial needs, and availability of workshops for teachers to attend, it was difficult to do all that was needed to provide additional trainings for teachers. Principals did not feel they would make any major changes to the activities that were already in place to improve science instruction. Workshop site coordinators felt that the greatest weakness occurred because of the limited availability of science content workshops. With FCAT scores affecting school grades in the next two years, they hoped that the Florida government and districts would provide more money specifically to science content areas professional development. Along with the normal struggles, this school year saw numerous changes to the school calendar due to many days of absences due to an unusual hurricane season. The changes in the calendar caused losses of workshop opportunities during the time we were out and on Wednesday afternoon when we lost early dismissal, time (school ended one hour early to provide time for workshop opportunities for teachers) to make up hours lost.

Findings

Principals and other science support staffs' reported beliefs and practices are aligned with the literature of effective in-service to improve teaching science. Principals, workshop site coordinators, science lab teachers and science lead teachers are working to provide teachers with productive opportunities to strengthen their understanding of the science content. All agree that teachers need to go beyond the repetition of definitions and memorized content knowledge to create a successful inquiry-based learning environment. More than 40 years after the science education reforms started, my participants all echoed Goodlad's assertion that, "The fundamental assumptions underlying the proposed courses are that science is much more than a simple encyclopedic collection of facts and that children in the primary grades can benefit from acquiring certain basic skills and competencies essential to the learning of science" (Goodlad, 1964, p. 56).

The limitations on science instruction improvements are largely related to funding for professional development rather than the beliefs and practices of those charged to improve it. Professional development opportunities are going through changes in both counties, and principals and workshop site coordinators are working to set up opportunities to enhance the teaching of science in the classroom. Many of my participants echo Guskey's assertion that, "Good evaluations provide information that is sound, meaningful and sufficiently reliable to use in making thoughtful and responsible decisions about professional development processes and effects" (Guskey, 2000, pg. 41). Schools have begun to work with the University of Central Florida to develop MSPD-2 workshops at on-site locations similar to the grant funded MSPD 30-hour institutes that

were held at the University to provided teachers with an enhanced professional development opportunity in the content area of science. They are trying to implement a program that was already created and has been successful in school sites to benefit teachers at those schools with a yearlong professional development. Participants seemed to have higher expectations of science instruction and the purpose of the workshops than I expected. Even the principal, whose background expertise was not science, understood the importance of the teachers having the deep content knowledge. She surrounded herself with people whose expertise was science to assist her in implementing her beliefs and practices.

Personal Connections to Research

Throughout the research, connections were made to my personal experiences that validated the participants' feedback. I have had the opportunity to attend two science workshops this school year, which focused on the Ecosystems, a strand of weakness in the science content area. The workshops were hands-on and inquiry-based lessons. We participated in several mini-labs similar to labs the students would participate in the classroom. This aided in helping the teachers become more familiar with the same lessons that are presented to the students. Our confidence level with those labs became stronger during the workshops. When the workshops were done, we received "goody bags" with supplies for some of the labs we had completed. We left the workshops prepared to teach some of the labs related to Ecosystems. After the workshop was completed, a follow-up was done on the internet where a survey was completed; resources were available to assist with topics discussed during the workshop if needed.

We were also encouraged to collaborate with colleagues who attended the workshop whether at our school or at another school within the county.

The science workshops I have attended strengthened my science content knowledge and were hands-on, inquiry-based lessons like those that we should be teaching. The workshops allowed me to gain the knowledge and confidence in areas I felt that were a weakness for me. We were able to practice labs with colleagues before presenting them to students. I have also seen changes in Orange County School District in the follow-up from professional development. There is a more thorough, purpose driven follow-up being provided rather than fill out a survey and turn it in. It provides excellent resources, ideas and collaboration opportunities after returning to the class and is easier to implement the training received. As much as I like teaching science and learning better ways for instruction, it is difficult to find the time to attend workshops being offered and getting the money for registration if it is required. With school and family commitments outside the regular school day, it becomes harder to attend trainings off campus.

Another connection I was able to make was when principals encourage teachers to share ideas and lessons at faculty meetings. It allows us to share ideas that were successful in our classrooms that might help other teachers to build the confidence that they need to incorporate more science labs into their lessons. Issues with time management with the entire curriculum we have to cover are important to address as well. On several occasions, my principal has discussed with our grade level the time constraints with teaching and we have developed a plan of how to approach what we need to accomplish. She comes to us on a regular basis to discuss how we are

progressing. She also meets with the other grade levels and our Science lab teacher to assess how everyone is implementing the instruction of science.

Budgets are always tight at all schools. With growing local populations, budgets are getting slimmer so my school does not bring in a professional development workshop for science instruction because of cost constraints. We do plan to use our science lab teacher to facilitate some training this coming year. However, since this was her first year and she had over a thousand students, the principal chose to wait a year before using her as a consistent professional development presenter for science.

I made connections throughout the research. I used this process as one form of triangulation of data to reaffirm what was shared with me through the interview process. As a teacher in one of the counties being studied, I was seeing some of the changes taking place as science gains in respect and importance in the classroom.

Limitations of Research

One limitation in the study is that many elementary teachers may feel apprehensive about teaching hands-on labs in their classroom. This apprehension can affect the increase in teachers' depth of knowledge about science content areas and hinder their students' success on the FCAT. The attended workshops may not be designed to impact teachers' beliefs regarding how science should be taught in the classroom.

Only a small sample of principals from each county participated in this grounded theory. I interviewed the workshop site coordinator from each county for the study. There was a small number of science support staff interviewed; however, there are only a few in the lab or resource teacher's positions at this time. Therefore, the findings apply to only a small part of the two counties. Furthermore, the principals who were selected

were involved in science at the county level or had shown strong support of science instruction at their schools. As a result, my findings are probably representative of what is happening at the district level, but must be interpreted cautiously for schools and principals not actively involved in science education.

Conclusion

The improvement in the teaching of science continues to rely on the principals and workshop site coordinators to provide opportunities for teachers to attend professional development. The organization and evaluation of in-service is crucial to the continued professional growth and changes in instruction, which requires individuals to act and to think in new ways. Due to science being an uncomfortable subject area most elementary teachers developing new ways to act and to think is a challenging goal. As Kinchin (2000) shows in his Appropriate Teaching Ecology design, three main parts of being an educator include teaching, learning, and change. All parts affect each other in the triangle of facilitation in the classroom. Along with the three outer edges of the triangle comes the part from within the educators to research and reflect at all times to enhance the teaching, learning, and change of the teaching ecology.

The implementation of the FCAT science test has provided us with the impetus to change the instruction of the science curriculum. Many changes are taking place across both counties. There are strengths and weaknesses in the program. Both counties realize their weaknesses and are always evaluating the programs that are in place to improve them. It is a long, arduous process but changes are being made. The workshop site coordinators, principals and science support personnel are working to provide teachers

with the best opportunities to increase their knowledge and comfort with the teaching of science and increase the impact of learning that takes place with the students.

> "Effective professional development experiences foster collegiality and collaboration; promote experimentation and risk taking; draw their content from available knowledge bases; involve participants in decisions about as many aspects of the professional development experiences as possible; provide time to participate, reflect on, and practice what is learned; provide leadership and sustained support; supply appropriate rewards and incentives; have designs that reflect knowledge bases on learning and change; integrate individual, school, and district goals; and integrate both organizationally and instructionally with other staff development and change efforts" (Loucks-Horsly, Hewson, Love, and Stiles, 1998, p. 36).

Both Central Florida counties are moving in this direction to incorporate all of the above beliefs for professional development, included the beliefs and practices of the principals to assist teachers in meeting the rising demands and expectations for teacher and student success.

Recommendations for Practice

In this era of state mandated assessment tests in reading, writing, math, and science combined with the pressure of state school grading and *No Child Left Behind* Act, it is critical for teachers to be well trained. The journey begins with taking college level classes. However, continued training and support needs to be ever increasing to make

sure teachers have the knowledge needed to prepare the students and show learning gains. Continued support by principals currently involved in improving the effectiveness of science instruction is needed, as well as, the encouragement of other principals to step up and support school districts and the state must continue to support science education in-service.

Professional development in two Central Florida counties is going through changes to better provide opportunities to drive teachers' beliefs regarding the deep knowledge of science content. The professional development can direct the teachers' changes. However, it has to be followed up with collaboration with colleagues, classroom observations and documentation of the practice that was learned by attending the workshop (Loucks-Horsley, et al., 1998). Principals are making changes in their schools to also guide the changes in beliefs of the teachers in the instruction of science. They are providing science lead teachers or science lab teachers to assist teachers and students in their understanding of science. Along with science support personnel, principals are encouraging teachers to share and collaborate with colleagues and better understand what does and does not work. The support of the principals encourages teachers to want to make changes that are not easy.

Recommendations for Future Research

Along with the changes that are already in place, there are several others that will be assessed in the coming years. Based on changes in professional development and increased support of administrators, future research might be able to identify an increase in inquiry-based instruction in the classrooms. All educational changes of value requires individuals to act in new ways (demonstrated by new skills, behaviors, activities, etc.)

and to think in new ways (beliefs, understandings, ideas, etc.) (Loucks-Horsley, et. al., 1998). Future research needs to assess whether this is happening. In addition, research should look at FCAT test scores to see whether these changes have improved the assessment of the science standards. Lastly, research should assess whether teachers have developed a deeper understanding of the science content.

1. A follow-up study assessing how the ever-changing process for professional development has benefited teachers in the subject area of Science.
2. Conduct a study with teachers to find out how the new design for professional development in both counties have helped or hindered them in becoming better science teachers.
3. Conduct a study looking at FCAT science test scores to see if a continued increase in student performance continues to take place with test scores after the implementation of improved professional development in both counties takes place.
4. Conduct a study looking at other counties in the Central Florida region to see what changes are taking place to improve the teaching of science.
5. Conduct a study looking at all principals in both counties and how the implementation of science on the FCAT has encouraged them to become more involved in the learning process of science and helping teachers improve their method of teaching science.

These future studies will examine the continued improvement of science education through various school districts across the state of Florida. The changes are already

beginning to be seen in science education. There are many obstacles to overcome but the steps are starting to take place.

APPENDIX A

FACILITATION OF INTERVIEWS

Facilitation of Interviews

1. Please tell me a bit about your educational and professional history leading up to your time as a workshop coordinator. (years of teaching experience, grade level, training in science education, years of experience doing professional development, training in professional development, books, and research read.)

2. What do you think are the most important things for students to learn about science? (beliefs about science and about science education)

3. Why is it important for students to learn those facts or processes? Of all the things that we might include in the science curriculum, why is that important?

4. What do you thing is the best approach to helping teachers teach science better? (beliefs about effective in-service)

5. Why do you think these approaches are effective?

6. Where did you learn these ideas?

7. What do you see as the strengths and weaknesses of these approaches?

8. Please describe for me how you normally work with in-service teachers. (their in-service practices and their beliefs about the effectiveness of their in-service practices)

9. What other ways do you work with teachers? How often do you do that?

10. What do you hope teachers learn during your in-service? How do you know whether they learned it?

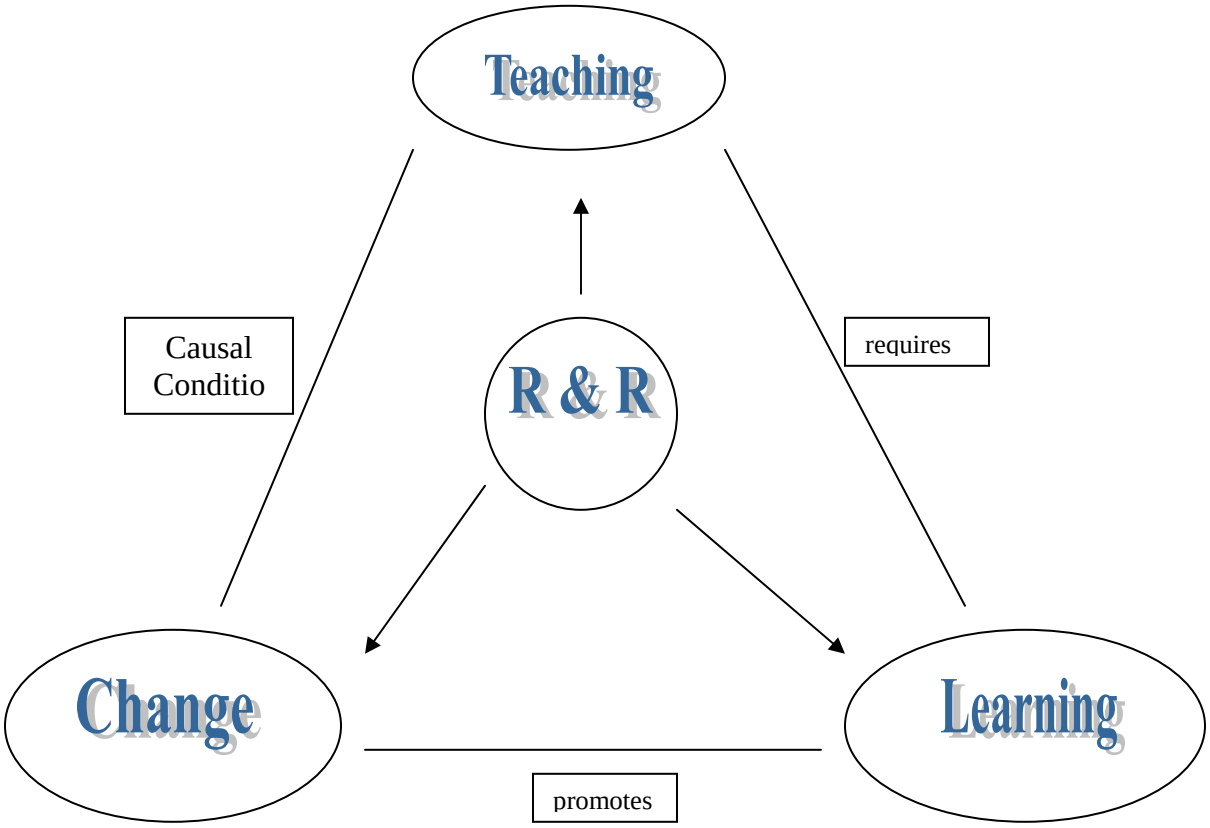
11. If there is a difference between what you think you should be doing and what you do, why is there a difference?

12. Repeat for clarification: 1) beliefs about science and science teaching, 2) beliefs about effective in-service, and 3) in-service and the reasons for those practices.

APPENDIX B

APPROPRIATE TEACHING ECOLOGY DIAGRAM

APPENDIX B



Appropriate Teaching Ecology

Kinchin, Ian M. 2002. School Science Review, 84 (306)

APPENDIX C

MEMBER CHECK MEMO

Dissertation Memo

To: Interview Participants

From: Valerie McKenna

Re: Dissertation Data

The data has been analyzed from the interviews that took place from May to July of 2004 for the dissertation, *Addressing the Impact That Workshop Site Coordinators and Administrators Have On the Teaching of Science in the Classroom.* Grounded Theory was used to illustrate the data (Attached chart) that was collected and used to establish a Central Phenomenon. The Central Phenomenon that was established was, in-service providers' and administrators' beliefs are aligned with the literature on effective in-service, and the conditions and context are ripe for changes in the intervening conditions that may lead to improved teacher knowledge, teaching, and learning. The big question still remaining for me is when the FCAT scores count beginning in 2006 do you feel that will change your approach to preparing teachers to teach Science from what is taking place at this time?

A summary of the reported findings included administrators and other science support staffs' reported beliefs and practices definitely, encourage the improvement in teaching science. Administrators, workshop site coordinators, science lab teachers, and science lead teachers are working to provide teachers with productive opportunities to strengthen their understanding of the science content beyond the repetition of thoughts that we learned when we were in school to create a successful inquiry-based learning environment for the students to once again ask "Why?" at all age levels. The limitations largely are related to funding for professional development rather than their beliefs and practice related to the instruction of science. Professional development opportunities are going through changes in Orange and Osceola Counties and administrators and workshop site coordinators are working to set up opportunities to enhance the teaching of science in the classroom. All participants seemed to understand more regarding expectations with science instruction and the purpose of the workshops the teachers were attending than I expected. Administrators seem to always be encouraging teachers to attend professional development to improve knowledge in any area of deficiency whether it is located at their on-site location or at an off-site location. Administrators who are motivated to help teachers improve their ability are going to increase the effectiveness in the classroom; however, there are outside forces such as funding, time, and resources that continue to have an impact on the depth the knowledge can be increased.

Science support people are challenging teachers to meet the needs of the students whether it is workshop site coordinators, a science lab teacher, or a science lead teacher. Science lab teachers and science lead teachers are at the schools to provide immediate assistance for teachers on a daily basis. Some Orange County schools have hired a certified classroom teacher to be a science lab teacher and accommodate additional student needs through a lab setting class during special area rotation, as well as, provide support for teachers through answering a simple question they have or providing

professional development opportunities for the teachers to strengthen their content knowledge. Osceola County schools are training lead teachers to be at each school as a resource for teachers to come to whenever needed and provide the additional support that they need to improve the teaching of science in the classroom. Math and Science Professional Development (MSPD) is being offered by certified teachers through the University of Central Florida for teachers to attend to strengthen their knowledge of inquiry based science through various strands of science content even if the cost comes out of their own pockets.

Now that we are three-fourths of the way through the school year, I wanted to follow-up with each of you and assess your feelings on implementations and/or changes that were going to be taking place during this school year. Were they successful? Why or why not? Do you agree with the summary of the findings I discussed above? Lastly, what are your thoughts again about when the FCAT scores count, beginning in 2006. Do you feel that will change your approach to preparing teachers to teach science from what is taking place at this time?

APPENDIX D

UNIVERSITY OF CENTRAL FLORIDA INSTITUTIONAL REVIEW BOARD

PERMISSION

University of Central Florida

Office of Research

March 3, 2004

Valerie McKenna
1851 Americus Minor Drive
Winter Garden, FL 34787

Dear Mrs. McKenna:

With reference to your protocol entitled, "Addressing the Impact that In-Service Coordinators and Administrators have on the Teaching of Science in the Classroom," I am enclosing for your records the approved, executed document of the UCFIRB Form you had submitted to our office.

Please be advised that this approval is given for one year. Should there be any addendums or administrative changes to the already approved protocol, they must also be submitted to the Board. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur. Further, should there be a need to extend this protocol, a renewal form must be submitted for approval at least one month prior to the anniversary date of the most recent approval and is the responsibility of the investigator (UCF).

Should you have any questions, please do not hesitate to call me at 823-2901.

Please accept our best wishes for the success of your endeavors.

Cordially,

Chris Grayson
Institutional Review Board (IRB)

Copies: Dr. Dave Boote
IRB File

12443 Research Parkway • Suite 207 • Orlando, FL 32826-3252 • 407-823-3778 • Fax 407-823-3299

Revised 11/03

THE UNIVERSITY OF CENTRAL FLORIDA
INSTITUTIONAL REVIEW BOARD (IRB)

IRB Committee Approval Form

PRINCIPAL INVESTIGATOR(S): Valerie McKenna

PROJECT TITLE: Addressing the Impact that In-Service Coordinators and Administrators have on the Teaching of Science in the Classroom.

Committee Members:

Dr. Theodore Angelopoulos: _____
Ms. Sandra Browdy: _____
Dr. Jacqui Byers: _____
Dr. Ratna Chakrabarti: _____
Dr. Karen Dennis: _____
Dr. Barbara Fritzsche: _____
Dr. Robert Kennedy: _____
Dr. Gene Lee: _____
Ms. Gail McKinney: _____
Dr. Debra Reinhart: _____
Dr. Valerie Sims: _____

[ ] Contingent Approval
Dated: _____

[ ] Final Approval
Dated: _____

[X] Expedited
Dated: 25 Feb 2004

[ ] Exempt
Dated: _____

Chair, IRB

Signed: _____
Dr. Sophia Dziegielewski

NOTES FROM IRB CHAIR (IF APPLICABLE): _____

APPENDIX E

INITIAL EMAIL CONTACT WITH ADMINISTRATORS AND SCIENCE SUPPORT STAFF

Subj:	**Doctoral Dissertation**
Date:	4/26/2004 12:36:25 PM Eastern Standard Time
From:	Mckennv
To:	

Dr. Osteen-

My name is Valerie McKenna. I am a Doctoral Student at the University of Central Florida and am currently a fifth grade teacher in Orange County Public Schools. I am working on my Dissertation with research on Science in the classroom. I would be interested in setting up an interview with you to discuss your assistance with teachers in preparing them to teach Science. I will be sending a formal letter to you through the courier, however, I wanted to touch base with you ahead of time to let you know a little bit about who I was. I would like to set up an interview during the month of May if you are available to meet with me for 45-60 minutes. Thank you for your time! Look forward to talking to you soon!

Sincerely,

Valerie McKenna

LIST OF REFERENCES

Anderson, R. C. & Mitchner, C. P. (1994). Research on science teacher education. In: Gabel, D.C. (Ed) *Handbook of Research on Science Teaching and Learning* (pp. 3-44). New York: Macmillan.

Beattie, M. (1995). New prospects for teacher education: Narrative ways of knowing teaching and teacher learning, *Educational Research*, 37, 1, 53-70.

Bell, B. & Gilbert, J. (1996). *Teacher development: a model from science education.* London: Falmer Press.

Boote, D., Wideen, M., Mayer-Smith, J. & Moon, B. (2003). *In-service Education, School Cultures, and the Failure of Curriculum Reforms: An Elementary Science Case Study.* Unpublished manuscript.

Brophy, J. E. & Good, T. L. (1974). *Teacher-Student Relationships: Causes and Consequences.* New York: Holt, Rinehart and Winston.

Center for Science, Mathematics, and Engineering Education (1997). Reflecting on Sputnik: Linking the Past, Present, and Future of Educational Reform. Retrieved June 2005 from, http://www.nas.edu/sputnik/dow2.htm

Clark, C. & Peterson, P. L. (1986). Teachers' thought processes. In Wittrock, M.C. (Ed) *Handbook of Research on Teaching* (pp. 255-296). New York: Macmillan.

Craven, J. A., III, & Penick, J. (2001). Preparing new teachers to teach science: the role of the science teacher educator. *Electronic Journal of Science Education*, 6(1).

Creswell, J. W. (1998). *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*. California: Sage Publications.

Dillman, D. (2000). Mail and Internet Surveys: The Tailored Design Method. New York: John Wiley and Sons, Inc.

Duffy, G. (1982). Fighting off the alligators: what research in real classrooms has to say about reading instruction, *Journal of Reading Behavior,* Vol. 14, 357-373.

Duffy, G. & Anderson, L. (1984). Teachers' theoretical orientations and the real classroom, *Reading Psychology,* Vol. 5, 1-2, 97-104.

Duffy, G. & Ball, D. (1986). Instructional decision making and reading teacher effectiveness. In Hoffman, J. (Ed) *Effective Teaching of Reading: Research and Practice* (pp. 163-260). Newark, Delaware: IRA.

Duschl, R. (1990). *Restructuring science education: The role of theories and their importance*. New York: Teachers' College Press.

Eisner, E. (1978). Humanistic trends and the curriculum field. *Journal of Curriculum Studies,* Vol. 10, 197-204.

Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research,* Vol. 38, 47-65.

Florida Department of Education (1996). Sunshine State Standards, standards for instruction of curriculum in the state of Florida. Retrieved April 2005, from http://www.firn.edu/doe/menu/sss.htm

Glaser, B. G. (1992). Basics of Grounded Theory Analysis. Mill Valley, CA: Sociology Press.

Glaser, B, & Strauss, A. (1967). *The discovery of grounded theory.* Chicago: Aldine.

Goodlad, J. (1997). School Curriculum Reform in the United States. **In D. Flinders & S. Thornton (Ed.)**, *The Curriculum Studies Reader* (pp. 45-54); (Originally published in 1964). London: Routledge.

Guskey, T. R. (2000). Evaluating Professional Development. Thousand Oaks, California: Corwin Press, Inc.

Hollen, R. E., Anderson, C. W., & Roth, K. J. (1991). Science teachers' conceptions of teaching and learning. In J. Brophy (Ed.), *Advances in Research on Teaching* (Vol. 2, pp. 145-186). Greenwich, CT: JAI Press.

Kagan, D. (1992). Implications of research on teacher beliefs. *Educational Psychologist*, 27(1), 65-90.

Kennedy, M. M. (1998) Education reform and subject matter knowledge. *Journal of Research in Science Teaching*, 35(3), 249-263.

Killion, J. (2002). Assessing Impact: Evaluating Staff Development. Oxford, OH: National Staff Development Council.

Kinchen, I. M. (2001a). Concept mapping in biology. *Journal of Biological Education,* 34(2), 61-68.

Kleibard, H. (1997). The Rise of Scientific Curriculum Making and Its Aftermath. **In D. Flinders & S. Thornton (Ed.)**, *The Curriculum Studies* (pp. 31-40); (Originally published in 1975). London: Routledge.

Little, J. W. (1982). Norms of collegiality and experimentation: Workplace conditions and school success. *American Educational Research Journal*, 19, 325-340.

Loucks-Horsley, S., Hewson , P., Love, N., & Stiles, K. E. (1998). Designing Professional Development for Teachers of Science and Mathematics. Thousand Oaks, CA: Corwin Press, Inc.

Luft, J. A. (1999). Teachers' salient beliefs about a problem-solving demonstration classroom in-service program. *Journal of Research in Science Teaching.* 36(2), 141-158.

McDonald, F. & Elias, P. (1976). *The Effects of Teacher Performance on Pupil Learning: Beginning Teacher Evaluation Study: Phase II, Final Report, Vol. I.* Princeton, NJ: Educational Testing Service.

National Commission on Excellence in Education (1983). A Nation at Risk, publication regarding the state of the nation in education. Retrieved April 2005, from http://www/ed.gov/pubs/NatAtRisk/index.html

Ohana, C (2002). Science and Children Journal-Editor.

Paris, S. G., Wasik, B. A. & Turner, J. C. (1991). The development of strategic readers. In: Barr, R. et al. (Eds) *Handbook of Reading Research* (pp. 609-640). New York: Longman.

Roehler, L. & Duffy, G. (1991). Teachers' instructional action. In Barr, R. et al. (Eds) *Handbook of Reading Research* (pp. 861-884). New York: Longman.

Strauss, A. & Corbin, J. (1997). Grounded Theory in Practice. Thousand Oaks, CA: Sage Publications.

Shulman, L. S. (1986a). Paradigms and research programs in the study of teaching. In: Wittrock, M. (Ed) *Handbook of Research on Teaching* (pp.1-36). New York: Macmillan.

United Stated Department of Education (2002). No Child Left Behind Act. Retrieved April 2005, from http://ed.gov/nclb/landing.jhtml?Src=pb

Yager, R. E. (1996). Science teacher preparation as a part of systemic reform in the United States. In J. Rhoton & P. Bowers (Eds.), *Issues in Science Education* (pp. 24-33). Washington DC: National Science Teachers Association.