

THE EFFECT OF SCHOOL CULTURE ON SCIENCE EDUCATION AT AN  
ELEMENTARY SCHOOL: AN ETHNOGRAPHIC CASE STUDY

by

LORI TURNER MEIER  
B.A. Milligan College, 1999  
M.A.T. East Tennessee State University, 2000

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Major Professor: David N. Boote

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## ABSTRACT

This ethnographic case study investigated one elementary school to understand how the school's culture influenced its science curriculum design and instruction. The main data was formal and informal semi-structured interviews with key teachers to understand their values, beliefs, practices, materials, and problems with science instruction. To triangulate these data, the researcher observed classroom practice, school-wide activities, and collected artifacts and documents. Data were analyzed using a theoretical framework that emphasizes that culture cannot be reduced to beliefs, values, practices, materials or problems, but rather each aspect of culture is interdependent and mutually reinforcing.

The main finding suggests that the school's culture is organized to accomplish other curricular goals than effective science education. Science is rarely taught by most teachers and rarely taught well when it is. While the teachers know the rhetoric of effective science education and value it enough to not dismiss it entirely, most value it less than most other subjects and they are not proficient with science instruction and materials. This study builds upon the literature by reiterating that school culture plays a central role in elementary science education, but adds to that literature by emphasizing that culture cannot be reduced to one or a few factors and must be seen as an organic whole.

This work is dedicated to my family who modeled for me the value of lifelong learning. To my parents, Dan and Hazel, for the great volumes of books you kept in the house and for the perfect childhood moments of caving, Chinese food, fuzzy animal slippers, and freedom rock. To my siblings, Gretchen and Ben, who understand the mysteries of the preacher kid life, door foil, and the fine art of placing Christmas lights in the bushes. And foremost, to my charming husband, Rob, whose presence makes home such a cozy place to be. Thank you for giving me daily confidence and encouragement.

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## CHAPTER ONE: INTRODUCTION

Large-scale, high profile reports have, for a few decades, steered educators in the direction of policy and reform initiatives. Prior to the mid-1980s not much had been accomplished by organizations of K-12 educators concerning the development of national standards for the specific content areas. In 1983, authors of *A Nation at Risk* published distressing news of the United States' ability to scholastically compete in an international arena. As a nation, students were not developing the intellectual abilities to think critically or engage our international counterparts in scientific knowledge and reasoning.

In 1986, the National Council of Teachers of Mathematics developed the NCTM Standards. These documents would provide the standards for a new wave of instructional practice, different than previous decades, hoping to invite children to the constructivist mathematical learning world and increase student achievement (Bybee, Ferrini-Mundy, & Loucks-Horsley, 1997). By 1991, the science teachers association followed a similar path and collaborated with the National Research Council to create their standards document. From 1991 to 1995 several drafts of these standards were created and open for discussion to the science educator's community. Finally in 1996, the National Science Education Standards (called the NRC Standards) were developed and launched. They presented, "a vision of a scientifically literate populace by outlining what students need to know, understand, and be able to do after 13 years of school science" (Bybee, Ferrini-Mundy, & Loucks-Horsley, 1997, p.98). The document also detailed standards for teaching science, assessment, programming, and professional development. Rationale for the standards was evident as standardized testing scores for the United States

remained unfortunate. Ten years later, greater achievements in science are still an elusive goal for public schools in the United States. Results from the National Report Card: Science 2000 (O'Sullivan, Lauko, Grigg, et al., 2000) cite stagnant growth in the area of science in grades four and eight and a decline in scores for grade twelve from prior reports in 1996. More recently, scores from 2005 (National Report Card, released May, 2006) of 300,000 students show increased scores for grade 4, and no change for grade 8.

For Floridians, science is rising as the new presence on the state standardized assessment. With its first scores in 2003, science ability for fifth, eighth, and tenth (changed to eleventh in 2005) graders (tested grade levels) were less than favorable. A year later, scores overall declined only slightly with the average score less than 300 in a 100 - 500 range (Florida Department of Education, 2004). Recent 2005 FCAT scores for Florida in science are similar. Fifth grade students scored an average 299 (out of a mean scale score of 500), up slightly from a mean scale score of 285 in 2003. However, this suggests that only 35% of students are achieving at or above grade level, leaving 65% scoring below grade level. Of greater consequence to Florida school administrators is the addition of student science achievement scores to the formula for the 2006 - 2007 school grading system. Without question, similar low science scores in future years might impact the percentage of schools able to earn and retain a school grade of "A" for their students' achievements.

Watters and Ginns (2000) propose that science education has a major role to play in the development of critical and informed citizens that will populate a fast-paced, rapidly changing society of technology. Best practices for effective science instruction in

the school is suggested by many to emerge from constructivist theory and while many can speak to what they know and what they think that teachers do - realistic classroom observation shows us that often, educational leaders and teachers forget to practice what they preach (Duckworth, 1987; Fraser, 1994; Loucks-Horsley et al., 1990; Payne, 2004; Tobin, 1993; Veronesi, 2000). While many sing the praises of constructivist science reform, some like Fensham (1992), believe that even though large rhetoric prevails - most communities of parents, teachers, and administrators remain unconvinced about the value of science at the elementary level and, therefore, are content with current science instruction that includes textbook-based, fact-driven busywork, and the memorizing of isolated scientific terms for tests. Teachers also are content with the status quo, as many of them feel inadequately prepared to teach scientific concepts. While the push for more science and a different kind of science instruction is visible, educators, according to Payne (2004), continue to place science as a second tier subject behind reading and mathematics.

### Statement of the Problem

The notion of school culture is currently active in public schools across the country. As schools look for ways to increase their teachers' and ultimately their students' proficiency in science, school culture maintains significant control in the school environment. For this research, the theoretical framework of school culture is redefined as the interrelated and interconnected relationships between school culture indicators (values, beliefs, practice, materials, and problems) and is provided by Balcaen, Boote, and Wideen (1998).

How might this concept of an existing school culture impact effective science teaching? Knowing the impact of a school's culture is vitally important to the role of the teacher (Peterson & Deal, 2002). It influences what teachers pay attention to (focus), how they identify with their school (commitment), their work ethic (motivation), and the success they achieve in relation to their goals (productivity). Cultures that hinder the school's effectiveness to employ and support "teachers of science" will need dynamic cultural change so that they are better equipped to address the increasing demands for effective science education in their elementary classrooms.

As previously stated, it is not a secret that many elementary schools and teachers' classrooms treat science as a less significant content area, with many teachers, merely touching on it once or twice a week (Kidder, 1989; Tilgner, 1990). If the culture of a school determines what is valued, believed, encouraged, eventually taught, and practiced will that school's culture prevent it from placing science higher up the priority list? Will teachers, being the main shareholders and practitioners of school culture influence or hinder effective science instruction? Are they even aware of this force of school culture guiding their thoughts and actions? Before teachers, schools, and the national education system in the United States can understand the complexities of their problems and situations they needed to understand the underlying reasons and the hidden realities of what truly exists (Sarason, 1971). Why do we, as teachers, do what we do? Why do we say what we say? Why are we resistant to the teaching of science? Sarason suggests, "Part the curtain, go behind a person's words, style, and appearance and you find another world you did not suspect" (p.321).

### Purpose and Significance of the Study

The purpose of this study was to address how school culture influences effective science curriculum design and instructional practice of teachers in the local elementary school setting. It aimed to better understand the nature of everyday science instruction in the elementary school. Fundamentally, this study addressed the interconnected culture indicators (its values, beliefs, practices, materials, and problems) and how those indicators, as an organic whole, supported or discouraged effective science instruction.

Much of the current body of literature in this area is focused on the large-scale outcomes of science initiatives without specific regard to the cultural structure of individual schools that might have participated in large studies. If cultural attitudes and beliefs translate into school practice, how could we as researchers accurately know where our successes or failures stem from when looking only at the comprehensive data? How does the culture of the school impact the success or failures of its students in the area of science instruction?

It is the thought of this study to dissect the local everyday school science education experience into its smallest pieces and then examine it by the sum of its cultural parts. By probing the real life values, practices, beliefs, materials, and problems of everyday stakeholders in the local elementary school, this research adds to the body of literature by showing real students, real teachers, and real educational communities at work in the public school system. Likewise, it seeks to realize greater significance by examining the precarious position teachers are in to develop and deliver effective science instruction when quite possibly, the nature and culture of the school unwittingly prohibits

them from doing just that. This research, the participants, its findings, and the inherent unique qualities of this specific school will be a worthy contribution to the field in assessing how school culture can influence science education.

### Research Questions

The overall fundamental research question guiding this study was:

- How does school culture (its values, beliefs, practices, materials, and problems) influence effective science instruction?

The question is articulated and reinforced by secondary questions:

- How does the Integrated Thematic Instruction model (ITI), along with the magnet structure of the school affect the teachers' science teaching?
- How do values and beliefs teachers express affect their science teaching?
- How do available materials & resources affect the teachers' science education practice?
- How do the perceived problems of teachers influence effective science instruction?

### Study Setting

For this ethnographic case study research, a site-specific, single-case design of one Florida elementary school location was used. The school is located in a low socioeconomic area but is attended by students from outside the area as well: a

characteristic of magnet schools. The school has functioned as a magnet school for over a decade and incorporates a Comprehensive School Reform Program.

### Study Population and Sample

The elementary school consists of a population of 550 students in grades K-6 with approximately 30 teachers, many with advanced degrees and National Board Certification. Diverse key informants were selected to represent the collective teacher population.

### Design and Methodology

This ethnographic case study inquired into the perspectives of teachers in one elementary school. I asked teachers their perspectives of, “why they do the things they do.” Data collection procedures consisted of semi-structured interviews, researcher observation, and artifact/document collection. Data analysis was conducted in light of the theoretical framework and conclusions were drawn.

### Assumptions & Limitations

As with any research, this study has assumptions and limitations, strengths and weaknesses. The strengths of this research design come from a variety of perspectives. The choice of a single-site design allowed the researcher to study the science education school culture experience in-depth, exploring several perspectives. The participant



school was open and welcoming of teacher-as-researcher assessment. I assumed that informants would speak candidly and honestly. This research strived to define best practice and desired to better understand how it relates to the greater cultural community of public elementary schools. Teachers are well qualified and experienced. They participate in various professional development offerings and consider themselves to be proficient educators. My previous role (recent teacher at the study school) effectively supports the design as I have a unique, experienced relationship with staff members there. Conversations were candid, frank, and fluid since the prior relationship exists and the participants felt little or no threat responding to the queries of the researcher.

This ethnographic case study design supported the notion of collecting thick descriptions of the culture in action and described the occurrences within it to determine how school culture influenced science education practices. This would have been a difficult research question to explore by quantitative means only. One assumption made by the author is that teachers would give candid responses to their science instruction within the semi-structured interviews. Teachers were reassured of their confidentiality when candidly commenting on elements of their school culture. The greatest limitation to this study comes from the researcher's desires for open and honest discourse amongst teachers in the school community without the researcher's personal biases hindering the work. I attempted to provide my personal biases within the initial discussions in the form of a research bracketing exercise; becoming aware of their existence, but avoiding letting the biases drive further discussions.

## CHAPTER TWO: LITERATURE REVIEW

### Introduction

This literature review is comprised of three distinct areas of concern to this research. The first section discusses the existing notions of school culture and is intended to highlight the inadequacies of previous research regarding school culture. It additionally lays the groundwork for a better model that becomes the theoretical framework for this project. The second section of this literature review lays the foundation for the current state of science education, elements of good science teaching, how teachers currently approach their science teaching, and the subsequent use of instructional practices and materials. The third and final section of this literature review introduces the Comprehensive School Reform Model and the selected program chosen by the case school, Integrated Thematic Instruction (ITI).

### The Role of School Culture

An extensive body of work exists in the area that has been called school culture and equally widespread are the definitions utilized in the field. Berger (1994) claims that, “it has been estimated that anthropologists have advanced more than a hundred definitions of culture” (p.136). Kroeber and Kluckhohn, as early as 1952, amassed over 150 definitions for the word culture. Readers may encounter definitions like those of Schein (1985) who suggests culture to be, “the deeper level of basic assumptions and beliefs that are shared by members of an organization, that operate unconsciously, and

that define in a basic ‘taken-for-granted’ fashion an organization’s view of itself and its environment” (p.6). Deal and Peterson (1999) liken the school culture to that of “an underground river of feelings, folkways, norms, and values that influence how people go about their daily work” (p.9). A simple and succinct definition might be that of Bower (1966) who asserts that culture can be described as merely, “the way we do things around here.” Of greater use to this research is the definition supplied by Balcaen, Boote, and Wideen (1998), who define culture as the interrelated and interconnected characteristics of a school’s values, beliefs, practices, materials, and problems. The specific usage of this definition will be elaborated and discussed in later sections.

The fields of both sociology and anthropology have contributed greatly to the discussion of school culture. Willard Waller, known for his sociology of schools in 1932, suggested that every school has a culture of its own and each school therefore, has its own collection of rituals, folkways, and moral codes (Peterson & Deal, 2002). Joseph (2000) maintains, “Anthropologists caution that people usually are unaware of the culture that surrounds them because culture appears as usual life, what seems normal or natural” (p.17). She continues, attributing a saying to anthropologist Margaret Mead that, “if a fish were to become an anthropologist, the last thing it would discover would be water” (p.17).

An underlying school culture exists in each and every school. The culture regarding the American nature of schooling also exists. It is the underlying symbolic glue that holds us together, within our schools and within our field. We can be aware of it or we can be naïve of its existence. It exists in the ways the facilities are constructed,

the offices ran, straight lines walked, a student's raised hand, a teacher's closed classroom door, a recited morning pledge, and the consequences for missing homework. The past decade has given us new elements to meld into our existing culture of school. Our culture now includes standardized testing, performance assessment for teachers, and increased levels of accountability.

On a cautionary note, the term *climate* is often confused and used intertwined with the term *culture*. Stakeholders in the school culture, might mistakenly confuse school climate (another term with many definitions) with school culture, incorrectly believing that their culture is the emotional responses to pep rallies or faculty meetings. School culture differs from climate. Climate, defined by Peterson & Deal (2002) is, "the feeling and contemporary tone of the school, the feeling of the relationships, and the morale of the place."

The notion of school culture is complex. John Goodlad (2004) was correct in his statement that, "alike as schools may be in many ways, each school has an ambience (or culture) of its own and, further that its ambience may suggest to the careful observer useful approaches to making it a better school" (p.81). Seymour Sarason (1971) asks us to consider why one might study school culture:

Before anyone devotes one's energies to understanding and changing schools - does not one first have to try to understand where one's conceptions about schools come from? As observers of schools we do not come to the task with blank minds. We come with images, expectations, and implicit and explicit attitudes. (p.14)

Sarason advises that before educators can tackle the complexities of their problems and situations they needed to understand the underlying reasons and the hidden realities of what truly exists. Why do we, as teachers, do what we do? Why do we say what we say? And are those voices and actions a true representation of what really is occurring? Sarason thinks it is possibly not so, “part the curtain, go behind a person’s words, style, and appearance and you find another world you did not suspect” (p.321).

The work of Patterson, Purkey, and Parker (1986) suggests that school cultures are created by its members and thus manipulated by them. School culture influences the classroom and the students. While school culture can be a positive energy, school culture can also be a negative, destructive, and divisive force working against the educational mission of the school. The culture of the school can be a possible downfall for any reform or change the school attempts to undergo.

Knowing the impacts of school culture is vitally important to the work of teachers (Peterson & Deal, 2002). It influences what teachers pay attention to (focus), how they identify with their school (commitment), their work ethic (motivation), and the success they achieve in relation to their goals (productivity). If teachers encounter school cultures where collegiality and growth are encouraged, than their personal commitment, scholastic drive, and motivation is increased. Similarly, if a school culture consists of hostile faculties, mediocre professionalism, laissez-faire attitudes, and low morale, teachers will adapt to those environments by poorly planning instruction, arriving and leaving early, suffering discontent, carrying a general attitude of malaise towards their students, and disconnecting themselves with the direction of the school.

### *Culture Redefined*

Essential to this discussion is a continued dialogue of the definition of school culture as defined and utilized in this study by Balcaen, Boote, and Wideen (1998).

Emile Durkheim, noted father of sociology, believed that sociology is a study of social facts and that these social facts are observable. These social facts include manners of acting, thinking and feeling, moral and legal rules, religious beliefs, and customs, which are external to the specific individual. Consequently, social facts can explain other social facts and are irreducible to specific criticism (Linde, 2003).

Incorporating Durkheim's 1952 definition that the study of culture is merely a study of social facts, Balcaen, Boote, and Wideen (1998) suggest that social facts are *sui generis* and are irreducible to further levels of analysis. For example, a school is made up of teachers, administration, students, parents, and community partners that construct and make decisions based on underlying interdependent belief systems. Therefore, as an example, one cannot blame student absenteeism directly on the parents, or the teachers, or the community that the student is from. Many factors might be at work in the combined nature of the absentee problem (even culture systems outside of the school culture) and therefore you cannot reduce it to one specific cause. Teachers, likewise, are products of an educational society and that society itself has characteristics that go beyond the individual and cannot be explained by individual criticism. Sarason (1996) agrees, "If your life's work is in schools, you have been socialized to see them in certain ways and to become insensitive to many things you take for granted and, therefore never

examine” (p.334). Within Durkheim’s perspective, educational systems mirror the society that they have been built upon and naturally seek to reproduce the values, norms, and conditions that are inherent to the society (Hoenisch, 2004).

As we look to further explore this definition of school culture, perspectives of both Durkheim and that of Balcaen, Boote, and Wideen (1998), again caution that we cannot look at isolated aspects or specific problems of culture to explain the culture as a whole. Instead, the study of school culture requires the complete interconnectedness (*sui generis*) of school culture indicators to explain each other. In light of their research, five *indicators of culture* can be recommended to describe school culture: values, beliefs, practices, materials, and problems. Gill and Boote (2006) suggest that the failure to see the *sui generis* nature of culture is the great weakness of much of the current “culture talk” in educational research and that by only examining how these indicators of culture reinforce each other can we truly see their interdependence.

### *Culture Indicators*

This research aims to seek and understand the interconnected relationships between values, beliefs, practices, materials, and problems to explain school culture; however, much of the literature discusses them in isolation. Although this research will view them together, an examination of each aspect of culture as it is chronicled in the literature is warranted. The reader is encouraged to keep in mind the *sui generis* nature and definition of culture this research explores.

The discussion of values in the literature is perhaps the most articulated aspect of culture, according to Detert, Louis, & Schroder (2001). They propose that values provide the meaning for social actions and their associated behaviors. Values provide the “should” as well as the “ought to” of organizational culture (Detert, Louis, Schroder, 2001). Values result from what Eisner (1992) classifies as ideologies. Ideologies are the belief system that provides values from which decisions about educational matters are made. He continues that, "Values, particularly in America, proliferate, and these values find their educational expressions in the ways in which schooling, curriculum, teaching, and evaluation are to occur" (pg. 302).

Teachers choose to teach those values that they hold as part of the larger collective society. While certain groups may differ from one another and certain rogue individual beliefs may come into view, the collective values of the group are what are translated to subsequent generations of members. Values are at the core of what a school community considers important (Peterson & Deal, 2002). It determines what is considered excellent or good and, “shapes behavior, decision making, and attention because people attend to what they consider important” (p.14).

In order to further suggest that we must look at the *sui generis* nature of culture rather than the isolated indicators of culture, consider the work of Schein (1992) regarding the indicator of “value” as a mere source for examining school culture. In their review, Detert, Louis, and Schroder (2001) put forward Schein’s comment that often what people say they value isn’t necessarily what they do. Their behavior can be quite



different from their proclaimed belief. Consequently, the need to look at more than just values is necessitated.

Beliefs are the “understandings about the world around us” (Peterson & Deal, 2002). Teachers, administrators, parents, and students carry beliefs about how they feel things in the school should or should not operate. Administrators *believe* that teachers are going to daily teach, while parents *believe* that their son or daughter has equal rights and access to learning as any other student. Teachers may *believe* that they are performing a greater societal good and students may *believe* that the teachers are in charge. Beliefs are what the shareholders deem to be true.

Beliefs also, for the purpose of this research, will include both norms and assumptions that a cultural society both claims and practices. Norms are the beliefs and expectations that are held regarding behaviors, dress, procedures, unstated rules, manner, etc. (Peterson & Deal, 2002). Norms have been quietly established to be followed and norms guide practice. For example, norms guide how you approach your principal, how to approach fellow faculty members, or how to address a parent in a conference setting. Deal and Peterson additionally suggest the notions of assumptions. Assumptions are a combined, “system of beliefs, perceptions, and values” (Ott, 1989, p.37). Assumptions can exist to guide possible thoughts of curriculum, instruction, or beliefs about the different natures of each learner (Peterson & Deal, 2002).

Practice, particularly instructional practice, has a rich literature base. Practice is what we choose to do, the actions we decide to take. It is the curriculum we choose to teach, the instructional methods it is delivered by, and the assessments made. Of great

consideration is the daily practice of the most influential stakeholder, the teacher.

Ashburn (1989) and others (Darling-Hammond & Sclan, 1996) propose that a school's culture is the most powerful predictor of a teacher's work within that school. As teachers construct their curriculum, daily lesson plans, and student goals, the conscious, or more likely, subconscious, implications of practice as an indicator of the greater *sui generis* school culture guide their decisions.

Imbedded in and accompanying teacher practice is the use of materials. In its simplest form materials are everyday paper and pencil; even more significant are textbook choice, access to office supplies, presentation systems, experiment apparatus, communication systems, computer access, workspaces, and certainly, the absence of materials. The specific use of science materials in relation to this study will be addressed in length further on.

Problems, perceived or demonstrated, are the final indicator of school culture suggested in this research. Schools, we know, and their teachers are complex and, likewise, so are their problems. In addition to teachers' predisposed personal values and beliefs are problematic organizational schemas that limit teachers and the organization from effective change and efficiency. In a report by Boyd (1992), the author suggests system barriers to organization change regarding teachers. In short, teachers begin to envision organizational reasons why things are the way they are. Organizational barriers include teacher's perceptions of school institutions as intolerant of change (Sarason, 1982) or a teacher's paranoia that school systems stagnate their growth as a professional (Goldman & O'Shea, 1990) justifying remarks such as, "they won't let me do it," or

“there they go again” (pg. 43). Crediting Fine (1991) with the notion that teachers look for ways to explain their efforts, Boyd suggests that teachers are looking to feel successful in what they accomplish. They believe in false assumptions to placate their own average accomplishments. Boyd (1992) points out several of what Fine (1991) reveals as teacher beliefs, such as: things can’t change, discipline keeps me from school success, I work with a “survivor” population, bureaucratic red tape and school boards encumber progressive education, and I’m doing the best job I know how to do in the classroom.

Fine (1991) advises that while the theory might help teachers feel better about their own practice, the assumption can hinder them from views about what might be possible in an organization if allowed to change. Additional limitations to change have also been suggested (Boyd, 1992) that pertain to increasing problems in collective school cultures. They include attitudes and beliefs about at-risk populations, student attitudes, community perceptions, burnout, cynicism to previous change, teacher turnover, and others.

### Science Education and Elementary Teachers

Large-scale, high profile reports have, for a few decades, steered educators in the direction of policy and reform initiatives. Prior to the mid-1980s not much had been accomplished by organizations of K-12 educators concerning the development of national standards for the specific content areas. In 1983, authors of *A Nation at Risk* echoed

distressing news of the United States' ability to scholastically compete in an international arena:

International comparisons of student achievement, completed a decade ago, reveal that on 19 academic tests American students were never first or second, and in comparison with other industrialized nations, were last seven times (National Commission on Excellence in Education, 1983, p.8).

In 1986, the National Council of Teachers of Mathematics developed over the course of a few years the NCTM Standards. These documents would provide the standards for a new wave of instructional practice, different than previous decades, hoping to invite and involve children to the constructivist mathematical learning world and increase student achievement (Bybee, Ferrini-Mundy, & Loucks-Horsley, 1997).

By 1991, the science teachers association followed a similar path and collaborated with the National Research Council to create the standards document. From 1991 to 1995 several drafts of these standards were created and open for discussion to the science educators community. Finally in 1996, the National Science Education Standards (called the NRC Standards) were developed and launched. They presented, “a vision of a scientifically literate populace by outlining what students need to know, understand, and be able to do after 13 years of school science” (Bybee, Ferrini-Mundy, & Loucks-Horsley, 1997, p.98). The document also detailed standards for teaching science, assessment, programming, and professional development. Rationale for the standards was evident as standardized testing scores for the United States remained unfortunate.

Twenty years later, greater achievement in science remains an elusive goal for public schools in the United States. Results from the National Report Card: Science 2000 (O'Sullivan, Lauko, Grigg, et al., 2000) cite stagnate growth in the area of science in grades four and eight and a decline in scores for grade twelve from reports in 1996. More recently, scores from 2005 (released May, 2006) of 300,000 students show increased scores for grade 4 and no change for grade 8. Grade 12 showed a decrease since the report in 1996, but no change since the 2000 report. A closer look at the scores for grade 4 suggest that scores improved for the subset labeled, *basic*, an increase from 63 percent to 68 percent. However, no change was reported for those students in the third subset of scores labeled, *proficient* – the desired goal (Grigg, Lauko, Brockway, 2006).

Of the 37 states participating, five states showed significant increases in both grade 4 and grade 8. Those states were California, Hawaii, Kentucky, South Carolina, and Virginia. Looking back at the 1996 results, only 19% of Florida eighth graders were cited as proficient in the area of science while 30% were categorized as basic performers - leaving about 49% of eight grade students seriously deficient and lacking in science knowledge and skills. In 2005, Florida fourth graders achieved 42% at basic, 32% below basic, while only 26% were classified at or above proficient. The 2006 results for grade eight showed no significant changes (Grigg, Lauko, Brockway, 2006).

For Floridians, science is rising as the new presence on the state standardized assessment. With its first scores in 2003, science ability for fifth, eighth, and tenth (changed to eleventh in 2005) graders (tested grade levels) were less than favorable. A year later, scores overall declined only slightly with the average score less than 300 in a

100 - 500 range (Florida Department of Education, 2004). Recent 2005 FCAT scores for Florida in science are similar. Fifth grade students scored an average 299 (out of a mean scale score of 500), up slightly from a mean scale score of 285 in 2003. However, this suggests that only 35% of students are achieving at or above grade level, leaving 65% scoring below grade level. Eighth grade students scored an average 289 compared to a score of 287 in 2003. Merely 32% of eighth graders are achieving at or above grade level (Florida Department of Education, 2006). Of greater consequence to Florida school administrators is the addition of student science achievement scores to the formula for the 2006 - 2007 school grading system. Without question, similar science scores in future years will take its toll on the percentage of schools able to earn and retain a school grade of “A” for their students’ achievements.

#### *Towards a Constructivist Viewpoint*

Watters and Ginns (2000) propose that science education has a major role to play in the development of critical and informed citizens that populate a fast-paced, rapidly changing society of technology. The National Science Teachers Association in a 2002 position statement suggested that we must provide opportunities for students to develop understandings and the skills that are necessary to participate and function productively as “problem-solvers” in a scientific and technological world (National Science Teachers Association, 2002).

Payne (2004), in reference to results from the National Science Foundation, suggests that the United States is not producing the volume of scientists and engineers

that will be needed to work in the industry in the years to come, an area where he suggests the fastest growth is occurring. Additionally, foreign-born workers who historically came to the United States are being presented with jobs elsewhere. According to Payne, the United States will be facing a critical shortage of scientifically trained workers and engineers. Loucks-Horsley and others (1990) propose that the numbers of students traveling the educational pipeline prepared for higher-level science are declining. While white students show decline in science, noticeably absent from secondary and collegiate science programs are African-American and Hispanic students.

With the notion that more technologically savvy means of communication, commerce, and everyday living will require an advanced, basic scientific literacy, organizations like the National Research Council saw fit to develop the National Science Education Standards in 1996. Supported by likeminded science societies and teachers' professional organizations, these organizations recommended science standards that would create problem solvers for a technological world. The definitions for "best practice" were born. Best practice in science, radiates from the understanding that science is more than a concrete body of knowledge; but instead, rather a way of thinking (Loucks-Horsley et al., 1990). Available monies and funding opportunities have also accompanied this constructivist science reform. During the 2004 fiscal year, the government-supported National Science Foundation comprised a \$663 million dollar budget for science education with an additional \$149 million allotted to states for grants of a mathematics and science nature (Galley, 2004).

Programs and promising fixes aside, the shift towards high stakes testing has illustrated the divide between the constructivist approach of the National Science Standards and the types of high-stakes testing states impose on their students. Advocates of performance-based science assessment challenge the one-dimension type testing, like the FCAT. Going so far as to criticize national testing reports, such as the Third International Math and Science Study (TIMSS), critics, like Peter Veronesi (2000) argue that, "There has been an ever-increasing realization that we are not getting students to think, and even if they are thinking, we have meager evidence to demonstrate it." (p.30)

This divide mirrors a similar dilemma found in today's classrooms and teachers. A large body of literature informs what we associate with scientific instruction "best practice." The real question becomes not in the new knowledge of the research but rather in the practice of that knowledge. Payne (2004) describes this shift as one from, "fact-intensive, textbook-based, lecture-driven science to idea-intensive, experiment-based science learning through project teamwork" (p. 34). Constructivist principles such as those of Duckworth (1987), Fraser (1994), Tobin (1993), and Tobin, Tippins, & Gallard (1994) have been shown to foster both positive academic and non-academic benefits. Among suggested practices are several guidelines (Loucks-Horsley et al., 1990). First, effective constructive science should garner 120 minutes per week in the K-3 grades and 300 minutes per week in grades 4-6. Students should be afforded the opportunity to articulate, test, modify, and abandon pre-existing ideas and adopt new ideas. Effective instruction also suggests that teachers use hands-on and minds-on approaches to their science lessons. Teachers should be creating science instruction meaningful for their



students (Watters & Ginns, 2000). In the utopian constructivist classroom, gone would be the traditional textbook bantering, memorization of isolated facts, and worthless factual tests. Students instead would be open to try new ideas, formulate hypotheses, experience hands-on learning, and connect new thoughts. Constructivism, according to Loucks-Horsley (1990), encourages us to, "rethink our assumptions about learning and, consequently, about instruction." (p.50)

While many sing the praises of constructivist science reform, some like Fensham (1992), believe that even though large rhetoric prevails - most communities of parents, teachers, and administrators remain unconvinced about the value of science at the elementary level and therefore are content with current science instruction that includes textbook based, fact-driven busywork, and the memorizing of isolated scientific terms for tests. Teachers also are content with the status quo, as many of them feel inadequately prepared to teach scientific concepts. While Fensham suggests that teachers mention a lack of preparation in the teaching of science those same teachers mention equal feelings regarding their lack of preparation in mathematics, which teachers do seem to make happen in their classrooms. An analysis of the literature regarding the teacher's role in the science classroom follows after a brief section on general teaching.

### *Successful Teaching Today*

Before we embark on the discussion of elementary teachers and their specific treatment of science, I will address the literature regarding what makes a good teacher. In the amplified arena of standardized testing, increased accountability, and unending

lists of standards, what does a teacher need to be able to do? While many teachers chose the elementary field because of their love for children, or desire to impact the greater society, it is unmistakable that the 'art of teaching' has quickly developed into the science of teaching. In order to succeed in this environment, Darling-Hammond (1997) suggests what teachers need to know and understand (p.294-298). Teachers must:

- Understand subject matter
- Possess pedagogical content knowledge
- Recognize levels of child development
- Comprehend differences that may arise
- Possess pedagogical learner knowledge
- Understand motivation
- Understand types of learning
- Assess student's knowledge and approaches to learning
- Command varied teaching strategies
- Recognize curriculum resources and technologies
- Collaborate
- Analyze and reflect on their own practice

Teachers will find that many of the suggested qualifications were not part of their teacher pre-service education. Until recently, many teacher education programs separated the aspects of educational theory and application from each other (Darling-Hammond, 1997). Beginning teachers received lecture hall treatment, textbooks, and instruction from many who hadn't practiced what they taught. Subject matter courses

were separate from teaching methods courses and both areas were separate from educational foundations courses and psychology. She adds that student teaching was a mere taste of *what was to come* and was unconnected with all prior learning. Certainly, when teachers entered their own classrooms, few benefited from what they learned in their preparation programs if they remembered the experience at all.

Initial positive classroom experiences proved to be of little encouragement as many U.S. teachers begin their careers in disadvantaged schools. Here the most inexperienced teachers are placed with the most challenging and “educationally needy” students (Darling-Hammond, 1997). High turnover rates, extra duties, and few materials all contributed to stress in the early years of teaching. In contrast, she notes that our system differs significantly with other countries in the area of teacher preparation:

By Japanese law, beginning teachers receive at least twenty days of in-service training during their first year on the job and sixty days of professional development. Master teachers are released from their classrooms to advise and counsel those beginning teachers. Early teaching experiences in both Japan and Taiwan involve new teachers in watching other teachers at length, discussing problems of practice, presenting and critiquing demonstrations lessons, and with groups of colleagues, imagining and acting out how students might respond to certain presentations of materials (p.324).

In the United States, teachers choose to leave the field as quickly as they chose to enter it. Statistics from the National Commission on Teaching and America’s Future (2003) suggests that one-third of teachers leave the field within the first three years of

teaching. Almost half leave within the first five years. In a similar implication, teachers that are academically talented, or those with other degrees in addition to their education degrees typically are the first to leave the teaching profession for other endeavors (Darling-Hammond & Sclan, 1996). For those that do survive the first five years of teaching, districts have done little to provide in-service or professional development training past the “one-shot workshop” wonder. While reform efforts are on the rise thanks to organizations such as the National Staff Development Council, previous efforts towards professional development were fruitless.

Teachers have varied working conditions depending on the geographic and socioeconomic areas that they teach. Job satisfaction is also diverse. Conley, Bacharach, and Bauer (1989) note a relationship between lower class size, manageability, and increased satisfaction. Similarly, teachers experienced decreased job satisfaction when presented with larger class sizes. Teachers are also vulnerable to feelings of isolation and frustration (Sarason, 1982). Teachers come under scrutiny from many avenues and do not regularly participate in controversial forums where educational ideas are debated. Division between districts and their teachers can be vast. In one study, teachers felt that their views of what constituted “good teaching” completely misaligned with their perceived views of what their district deemed good teaching (Darling-Hammond, 1997). Seventy-nine percent of teachers described “concerns for children and for learning as central to good teaching,” (p.83) with eleven percent believing that the district shared their view. Seventy-five percent of teachers felt that their districts practiced “behaviorist learning theories” (p.83).

### *Elementary Science Teaching*

Although much rhetoric is communicated between teachers and science organizations, in reality, elementary science classroom instruction does not typically reflect the ideals of their science leaders. While the push for more constructivist science is capable of being heard, educators, according to Payne (2004), continue to place science as a second tier subject behind reading and mathematics. Further, he suggests that those same educators cite second tier treatment of science in their college methods courses.

In general, elementary teachers are not adequately prepared to teach science content. Lederman (1992, 1998) argues that teachers are unable to deliver or evaluate information that they do not personally possess. The 2000 National Survey of Science and Mathematics Education (Fulp, 2002) issued the report, *Status of Elementary School Science Teaching*, with notable findings. As a group, only 4% of elementary science teachers have undergraduate degrees in science areas or specifically in science education. The majority of teachers earn degrees in elementary education. While most elementary education programs offer methods courses in science, they are basic at best. The National Survey suggested that 40% of teachers took four or less semesters in scientific coursework in their undergraduate degrees and within those courses they leaned heavily on the life sciences (92%). Additionally, 83% of teachers took a course in earth and space science, 62% in physics, and 53% in chemistry. In relation to the NSTA guidelines for what constitutes good science coursework background (life science, earth & space science, physical, and environmental) only 54% of elementary science teachers met those qualifications.

An elementary school teacher's day, we are aware, is not devoted to the sole teaching of science. Elementary teachers in the United States are generally expected to teach reading, language arts, mathematics, and social studies. The National Survey asked teachers to respond to their perceived preparedness in academic areas that they would be likely teaching. According to survey data, less than 28% of teachers in K-5 felt *very well qualified* to teach science content areas. Conversely, 77% of teachers responded that they felt *very well qualified* to teach reading and language arts, and 66% responded that they felt *very well qualified* to teach mathematics. Teachers are generally aware of their lack of content preparation in science and often cite this as their reason for failing to be aware of science initiatives and their treatment of the subject as a lesser discipline. When asked about their familiarity with the National Science Education Standards, 64% in grades K-5 and 70% in grades K-2 indicated that they were *not at all familiar* with the document (Fulp, 2002). This may be likened to a lawyer who is unfamiliar with city ordinances and regulations to perhaps, a clergyman unaware of his religious text.

While teachers do not feel prepared to teach science well they are aware that it is, generally, an expected discipline to be taught in their classrooms. This may or may not occur. In the elementary classroom, we know that teachers often avoid science instruction entirely (Tilgner, 1990; Appleton, 2006; Appleton & Kindt, 1999 ). Take for instance, Chris Zajac, an elementary teacher described in *Among Schoolchildren*, by Tracy Kidder (1989):

Chris didn't know much science and didn't usually enjoy teaching it. Sometimes she let creative writing encroach on science's time. About one day in ten she

canceled science altogether and announced - to cheers, Felipe's the loudest - an informal art lesson. She often felt guilty about science (p.32).

Teachers in the National Study (Fulp, 2002) responded to teaching science everyday and cited an average of 25 minutes per day in grades K-5. In comparison, teachers responded an average of 114 minutes spent in the area of reading and language arts. Time spent in daily instruction varied from classroom to classroom. One Indiana study demonstrated that in their research of 1200 teachers, the mean number of science minutes taught was 14.7 minutes a day (Finson & Linsowski, 1996). While teachers in these studies reported the daily teaching of science, achievement scores remained low. On an interesting note, of the eighth grade students involved in the 1996 NAEP assessment that performed so poorly, 89% of the students stated that they had, in fact, received science instruction everyday in school (O'Sullivan, Jerry, Ballator, & Herr, 1996).

Current instructional strategies in the teaching of science are varied and traditional. While many teachers are quick to declare the types of instructional practices evident in their classrooms, observation can inform otherwise. King, Shumow, and Lietz (2001) suggest this in their research looking at teacher beliefs and classroom practice, noting a large disconnect between what teachers said that they were doing (hands-on, inquiry-based work) and what they found to be occurring in their observations. Further, they suggest that researchers should be wary when looking at the self-reported documentation of perceived teacher practice, "given the great disparity between what

teachers stated were their practice and the reality of the situation, the value of self-reported program documentation and evaluation must be called into question” (p.106).

Van Driel, Beijaard, and Verloop (2001) encounter similar findings. They concluded that experienced science teachers craft, over time, their knowledge and beliefs about the subject area and that those beliefs are translated and consistent with their classroom practice. However, those teachers have difficulty transforming innovation (which they may wholeheartedly believe in) into practice. Teachers choose instructional strategies from a repertoire of what they believe have worked for them in the past (Van Driel, Beijaard, & Verloop, 2001; Appleton & Kindt, 1999). They often choose those that are familiar or that they remember being taught science with. Teachers resist the idea of changing their practice when deep-rooted beliefs exist (Van Driel, Beijaard, & Verloop, 2001) and often, teachers, so anxious of teaching science, will inadvertently translate their anxiety to their students by either demonstrating a complete avoidance of the subject or providing an "authoritarian" presentation of factual terminology to their students (Easley, 1990).

The language of science constructivist theory is also widely represented in the literature. Teachers routinely encounter the words: hands-on, minds-on, inquiry based, discovery learning, etc. with differing definitions. While one teacher may believe he or she is teaching a hands-on lesson by merely passing around an igneous rock sample, a colleague may have students engaged in a “scratch test” searching for characteristics of specific rock samples with charts, scratch plates, and assorted scratching items and label that as hands-on science. Both teachers could assume that they are dually participating in



constructivist based hands-on science. In the NAEP data, where students performed poorly, sixty-four percent of teachers reported using hands-on science activities at least once a week (O'Sullivan, Jerry, Ballator, & Herr, 1996).

In King, Shumow, & Lietzs' (2001) case study research, one teacher refers to her own classroom instruction by stating the word, "hands-on," eleven times. Another teacher defined hands-on as, "if you're doing something" (p.101). What they did discover from these teachers were classroom practices that included: round-robin reading of the science textbook, low level recall questions, seatwork, small group work with unrelated data sets, some before-reading brainstorming, and reinforcement of classroom management issues and student discipline.

Materials and resources can also impact the teaching of science effectively. Widely used, the science textbook (a billion-dollar industry) is evident in 77% of classrooms in grades 3-5 and evident in 66% of classrooms in grades K-5. Teachers in grades K-5 who used the textbooks responded that they covered a mixed percentage of the text during the course of the school year. 33% covered 50-74 percent, 24% covered 75-90 percent of the text, while 22% of teachers covered more than 90% of the textbook (Fulp, 2002). Teachers also use a variety of different materials to teach in a more constructivist manner. This might include DVD, CD-ROM programs, VHS, computers, microscopes, overheads, science manipulatives (such as magnets, beakers, spring scales, triple beam balances, thermometers), and an assortment of consumable materials (Kleenex boxes, toilet roll holders, clay, batteries, etc).

The literature regarding teacher's perception of materials carries a common theme. Plummer and Barrow (1998) as well as Ruby (2006) suggest that insufficient materials and supplies are often cited as a top problem that teachers face. In one study, only 41.8% of surveyed teachers felt that they had access to materials. Equipment was not present in 60.5% of the classroom and was often old. A few teachers suggested that they personally spent as much as \$300.00 to equip their classroom and students for science (Finson & Lisowski, 1996). While teachers desire adequate materials, they also need to be able to use them in their instruction and translate the materials into their practice (Cohen & Ball, 1998) suggesting that in addition to the physical availability of materials, training on how to use the materials is also justified.

### Comprehensive School Reform Models in the Elementary School

In order to properly explain the unique aspects of the community in the study, this brief section attempts to inform the reader of an integral part of the makeup of the school with a simple review of the existing literature available on the topic. With this prior knowledge, an understanding of the school in question is better illustrated. The topic of integrated curriculum design, specifically Integrated Thematic Instruction (ITI) is discussed.

It is common in recent days, to observe districts and administrators jumping headfirst into whole-school reform projects that are often supported by federal grant monies. Schools ride the "wave of reform" hoping it will fix all that it promises to. Known as Comprehensive School Reform models, these programs attempt to revitalize

schools. Such models include, Responsive Classroom, Glasser Quality Schools, Core Knowledge, Integrated Thematic Instruction, and Different Ways of Knowing. These packaged methodologies encourage wide-ranging instructional practices, brain compatible instructional methods, character development, discipline plans, and the like.

Comprehensive Reform Grants often promise innovative changes for schools that adopt their programs. Giles and Hargreaves (2006) suggest in their research that innovative schools are quick to receive recognition in the short term for promoting new ideas in regards to teaching and learning. However, in the long term, many schools carry what they see as a “well documented tendency to fade after an initial golden age.” Drawing many of their conclusions from the work of Fink (2000), Giles & Hargreaves (2006) offer the idea that innovative schools possess a predictable, evolutionary life span. Schools often rejoin with mainstream schools and begin to look again like any other school (Giles & Hargreaves, 2006; Dorneus, 1981). Further, forces within the school such as leadership changes, loss of key faculty, district goals, student body changes, parental support, and often teachers’ own “traditional inclinations” will draw the “school’s center of gravity back towards the conventional grammar of schooling” (pg.125).

A central curricular strategy of Integrated Thematic Instruction, the one utilized by the sample school and its teachers in this research, is the construct of integrated curriculum. Curriculum integration is fundamental to the ITI reform product. McBrien and Brandt (1997) define curriculum integration as, "a philosophy of teaching in which content is drawn from several subject areas to focus on a particular topic or theme."

(p.55) The National Council of Teachers of Mathematics (2000), suggests the integration of science and math whenever possible. While research exists on a breadth of topics regarding integrated curriculum successes and failures, there is a small body of research concentrating on the Integrated Thematic Instruction reform model.

Clearly absent from these grant fixes, is the academic discourse concerning the effectiveness of these instructional reform programs and their fit to specific school frameworks and areas slated for reform. In regards to this reform model, ITI, the research base is quite small. The Comprehensive School Reform Quality Center (2005) published its November 2005 report on the nation's top reform programs. The Center is funded by the U.S. Department of Education and is based on 800 studies of 22 widely used Comprehensive School Reform (CSR) models. The model, Integrated Thematic Instruction (ITI), is one of those reviewed. In their review, the program required the expenditure of over \$200,000 during the course of the initial three-year implementation.

In regards to student achievement, the report noted "limited" effects of the program overall and "limited" effects of the program in the area of reading. In the areas of science and mathematics, the program is rated "zero" in its impact on student achievement in these areas (no significant increases in scores). Doctoral work by Ruth (1998) cites positive results of ITI students on the state's standardized reading test as compared to a control group, but cites equal gains after two years of implementation. Additional small reports, anecdotal pieces, and papers have been presented - most without quantitative data. Internal research provided by a Kovalik associate, Cathey H. Frederick (2004), cites positive growth to schools that were awarded Comprehensive

School Reform Grants. Research on the topic of brain compatible education exists (a key tenant of the program), with the cautionary note that brain research in education “proves” nothing. However, little literature exists on the specific effects of Integrated Thematic Instruction on the school, and more specifically its impact on science achievement and practice at the elementary level.

## CHAPTER THREE: METHODOLOGY

### Introduction

To address the weaknesses identified in the existing literature on the effect of school culture on science education, this study examined how one elementary school's culture (its values, beliefs, practices, materials, and problems) influences effective science instruction at the elementary level. For this reason, an ethnographic case study was the most appropriate research design (Creswell 1998; Denzin & Lincoln, 2000; Stake, 1995; Yin, 2003). The case study methodology was selected and combined with ethnographic approaches to data collection and analysis to examine the complex social phenomenon occurring at the school (Yin, 2003).

### Design

Yin (2003) suggests that case study methods allow investigators, "to retain the holistic and meaningful characteristics of real-life events" (p.2). Further, Yin's five components of case study research design were applicable: *study questions* asking the how and why teachers approach science, *propositions* that direct attention to what should be studied (in this case, the five indicators of school culture), selection of the school key informants as *units of analysis*, *logical linking of data* to the stated propositions, and the selection of criteria for the *interpretation of the findings* (categorization of data).

While ethnography has historically examined the ways of life for larger cultural groups, contemporary ethnography allows for the examination of smaller micro-communities, such as the classroom or other subculture (Hatch, 2002). While the

theories and methods of ethnography have been much debated (Agar, 2006; Creswell, 1998; Denzin & Lincoln, 1994; Hatch, 2002; Wolcott, 1999), at its core ethnographic methods simply asks, “What is going on in this social setting?” Ethnography, according to Hatch (2002), attempts to describe a particular culture from the point of view of its participants. Ethnography is interested in its subjects’ perspectives, asking common question such as, “What do they think?” or “How do they make sense of their community?” for instance, the values, practices, material use, and beliefs underlying a culture’s choices and actions. Ethnographers work on the idea that, “there is important knowledge which can be gained in no other way than just *hanging around* and *picking things up*” (Walford, 2001, p.8).

### Research Questions

This ethnographic case study inquires into the culture of one elementary school. To understand how school culture influences science instruction, the main research question guiding this study is:

- How does school culture (its values, beliefs, practices, materials, and problems) influence effective science instruction?

The question is articulated and reinforced by secondary questions:

- How does the Integrated Thematic Instruction model (ITI), along with the magnet structure of the school affect the teachers’ science teaching?
- How do values and beliefs teachers express affect their science teaching?
- How do available materials & resources affect the teachers’ science education practice?

- How do the perceived problems of teachers influence effective science instruction?

An ethnographic case study is the most appropriate means of answering these questions. Participant experiences were expected to be unique and given to interpretation recognizing that the phenomenon of “culture” is subjective. This research design allowed the observer to see how individuals make sense of their natural settings and experiences within that setting and then draw conclusions in light of a theoretical framework.

### Theoretical Framework

Emile Durkheim, acclaimed sociologist, believed that sociology is a study of social facts and that these social facts are observable (Hoenisch, 2004). These social facts include manners of acting, thinking and feeling, moral and legal rules, religious beliefs, and customs, which are external to the specific individual. Balcaen, Boote, and Wideen (1998) reassert Durkheim’s claims that that social facts are *sui generis* and are irreducible to further levels of analysis.

Essential to this research is the definition supplied by Balcaen, Boote, and Wideen, (1998) who define culture as the interrelated and interconnected characteristics of a group’s values, beliefs, practices, materials, and problems. This theoretical framework guides the data analysis in order to answer the research questions presented and discuss how values, beliefs, practices, language, materials, and problems all support each other within the established school culture. This research contends that we can no longer look at isolated aspects or specific problems of culture to explain the culture as a



whole. Instead, the study of school culture requires the complete interconnectedness of school culture indicators to explain each other.

### Participants & Case Setting

Well-developed sampling decisions are considered crucial for soundness of qualitative studies (Marshall & Rossman, 1995). With that knowledge, a limited, site-specific school was chosen. Further, the choice of a one-school case study design allowed for the understanding and study of its operations in depth and the influence of school culture on the science instructional practices of its teachers. Sarason (1996) suggests that if we want to understand another person or setting that we should become part of or experience that setting. He continues, “You can never comprehend the force or impact of a setting on its members unless, at the least, you have in some way become part of that setting ... as long as you remain an outsider looking in you will disappoint yourself and others” (pg.3).

As I asked teachers their perspectives into, “why they do the things they do,” I looked to both the emic (insider’s view) and etic (researcher’s interpretation) perspectives of participant responses to how school culture influenced their personal beliefs, practices, and actions in regard to their science instruction. The greater emphasis was placed on the etic perspective as the study is designed to draw conclusions relevant to the theoretical framework discussed in Chapter 2 and further in this chapter.

For this research, a site-specific design of one elementary school location was selected (pseudonym Happy Valley Elementary Magnet School). Happy Valley consists of a population of 550 students in grades K-6 with approximately 30 teachers, many with

advanced degrees. Four teachers claim National Board Certification. Teachers in grades K-6, instructional assistants, and other specials area teachers as well as administrators were asked to participate in the study. Of those participants, seven teachers were selected as key informants and agreed to participate in semi-structured interviews. These key informants evenly represent the teacher population. They represent almost all grade levels and all magnet areas.

Seven key informants were interviewed in semi-structured formats according to the interview protocol questions (Appendix D). Of the seven teachers, some were eager to be interviewed, while three teachers were sought out for their perspectives. Interviews were conducted with teachers at their convenience. Typically, the interviews were conducted after school and held in the teacher's classroom, with one exception where the interview was conducted at a local coffee shop. The interviews were semi-structured and carried a casual, collegial tone since the researcher was known to all participants. Participants were eager to assist the researcher and her goals of collecting data and ultimately, the attainment of a graduate degree. The interview was guided by the interview protocol document created by the researcher (Appendix D). Most interviews were conducted within one hour and were transcribed at the permission of the participants and by consent form. Teachers were asked to candidly comment on a variety of guiding prompts that created conversation and discussion.

Teachers were provided full disclosure of the purposes and existence of the study occurring in the school (Marshall & Rossman, 1995). The study inquired of teachers their personal beliefs and attitudes about science curriculum planning, their style of

instructional practice, their everyday practical use of materials, and their experiences and problems within the school community and the school culture. Additionally, teachers were asked to comment candidly on the experiences using the ITI "constructivist" comprehensive reform model, their use of required/elective materials, their access to materials, and their personal science practices with utmost confidentiality. Teachers were asked to reflect on their perceived teaching values; its impact on their science instruction (practice and materials included), and the problems they encounter within the structure of the school.

The school operates under a “magnet” philosophy, has greater than forty percent of its students qualify for free and reduced lunch, receives federal Title One monies, and offers curricular programs to attract out-of-area students to enroll. Students select one of four “magnets” at the end of grade three and are instructed through the fourth, fifth, and sixth grades under district and state general curriculum standards. Added to the general curriculum are programs that target and encourage student choice in the four magnets: Performing Arts, Arts & Cultures, Math & Science, and Microsociety.

The School of Performing Arts endeavors to provide a curriculum where students are given, “the opportunity to creatively express their unique talents and to learn through a variety of experiences including music, drama, dance, and media arts technology. Each of the three grade levels focus on a different aspect of the performing arts. Those individual aspects are then integrated into the academic curriculum, which heightens the interest level of the students” (School Statement, 2006).

The School of Arts and Cultures similarly encourages the premise that, “An understanding of global diversity is critical to successful and productive citizens of the world. Language is the conduit for peace and understanding. Exploration and expression through the Arts are necessary for the development of our society and to enhance the aesthetic qualities of our citizens” (School Statement, 2006) therefore, students learn about the culture of the world and the implications of art in society.

The School of Microsociety desires that students experience their role of a citizen as a leader in their community. “Students have their own post office, bank, court, and senate. They assume multiple responsibilities in the community that contribute to the environment and culture. By using the Integrated Thematic Instruction model, students have hands-on experience with real life job situations” (School Statement, 2006).

The School of Math and Science offers students an exclusive community in which they can participate and excel in mathematics and the sciences. They are given the opportunity to receive, “a solid introduction to the scientific process” and further, “students will be engaged in multiple real life experiences as they study the world of math and science” (School Statement, 2006).

The school implements Kovalik’s Integrated Thematic Instruction (Kovalik & Olsen, 1994) as a whole-school program and all teachers are obligated to abide by its guidelines. The school is located in an economically disadvantaged area. It is a diverse population of African-American and Caucasian students with Hispanic students comprising less than five percent of the school population. The school earned the school grade of “A” for four consecutive years under the A+ state school grading plan and met

Adequate Yearly Progress (AYP) according to the State of Florida for the 2004-2005 school year for the first time. Scores in science for fifth grade test takers on the FCAT are considered unsatisfactory after two years of testing.

This school has a set philosophical belief in the integrated curriculum reform model otherwise known as, ITI, authored by Susan Kovalik and Associates. It is a core expectation of the administration at the school that teachers will foster the environment laid out in the program and participate fully in the curriculum planning process. Those who do not subscribe to the program are encouraged to seek teaching opportunities elsewhere. Integrated Thematic Instruction is a model for implementing current brain research into a sustainable learning environment for students.

Implemented in a school-wide campaign at the case school five years ago, ITI encourages educators to become "constructivist" curriculum makers and design curriculum for their classroom communities in the form of yearlong themes. The key components of these themes are often science or social studies topics. This lends an interesting perspective to the research since administrators and teachers at this school insist ITI and the integration of curricular areas foster a deep, shared, cultural value that supports scientific thought and scientific literacy superior to traditional practice of other elementary schools.

#### Data Collection

Marshall and Rossman (1995) cite four fundamental methods for gathering data in the qualitative research study: participation in the setting, direct observation, in-depth interviewing, and document review. All of these methods were used in this research.

Data was collected to triangulate the findings and consisted of semi-structured interviews, researcher observation, and artifact/document collection.

The study took place in the second semester of the 2005-2006 school years. After completing the dissertation proposal defense and securing the appropriate IRB documentation and approval, permission of the school district was sought and granted (Appendix B). Consent from the selected school site was also granted by the principal. Next, teachers at the case school were introduced to the study and invited to participate. Informed consent forms (Appendix C) were distributed to the faculty. Since I was previously a member of the school community a bracketing exercise was conducted to expose possible research biases and experiences with the school community (Appendix E).

Yin (2003) suggests the great benefits of using multiple sources of evidence or triangulation, “the use of multiple sources of evidence in case studies allows an investigator to address a broader range of historical, attitudinal, and behavioral issues. However, the most important advantage presented by using multiple sources of evidence is the development of converging lines of inquiry” (p.98). This notion of using multiple sources is also recommended by Stake (1995). Concurrently at Happy Valley, classroom and school observations, both direct and informal (Yin, 2003) were additionally noted and gathered over a period of four months (in addition to the researchers previous four year participant-observer connection to the community). The investigator made weekly trips to the school site. Artifact collection, an unobtrusive method that richly portrays the values and beliefs of participants (Marshall & Rossman, 1995) was also initiated and

often provided by the participants themselves. As an analytic strategy (Yin, 2003) this triangulated data was compared to the theoretical framework of *school culture* to draw conclusions and assertions tailored to the research questions.

### Data Analysis

Teacher interviews were transcribed, categorized, and analyzed to identify significant comments regarding values, beliefs, practices, materials, and problems in relation to their science teaching. Comments were categorized according to the specific cultural indicators that were expressed in the participant's responses (Miles & Huberman, 1994). Five categories were created: values, beliefs, practice, materials, and perceived problems. Teacher's comments were placed in one or more categories as appropriate. Common converging ideas and evidence (Yin, 2003) present in each category were determined and examine in light of observation and collected documents.

From these categories assertions were developed to answer the four research sub questions. Yin (2003) asserts that the most preferred strategy for analyzing case study evidence is the return and reliance on the theoretical propositions that were initially developed and framed at the onset of the study. These propositions took shape in the form of the theoretical framework and its subsequent four interrelated research sub-questions that support the conclusion of the core research question. These assertions are supported by examples (explanation building) taken from the semi-structured interviews, observation, and artifact collection. They are described with teacher anecdote and quotes when necessary. The findings were again cross referenced with the researcher personal bracketing exercise (Appendix E) to address the notion of researcher bias.

As a final exercise, the main conclusion and assertions developed were provided to participants in the form of a member check. Participants were reminded of the confidentiality of their responses and identities and were asked to comment on the findings that were present to them which included the main finding and the secondary assertions detailed in Chapter 4. Of the seven informants, five chose to comment on the findings. Four participants stated that they wholly agreed with the findings. These four teachers provided little to no comment elaborating their agreement to the findings. An additional teacher presented comments addressing the main finding and each secondary assertion. Her detailed comments included her general agreement with the findings presented. She did elaborate on the notion that she feels that the innovative teaching at the school helps children to have a better understanding of the skills (addressing secondary assertion one) and that science teaching does occur in her classroom even when she is out of her magnet (addressing secondary assertion two).



## CHAPTER FOUR: DATA ANALYSIS

### Introduction of Findings

The case study at Happy Valley Elementary Magnet School suggests that the existing school culture is organized and driven by curricular motives and subsequent day-to-day routines in areas other than effective science instruction. Therefore, the norms, values, beliefs, practices, ceremonies, rituals, traditions, use of materials, and perceived problems of all stakeholders in the school community contribute to a tenor of indifference within the school in regards to effective science instruction. Although, this treatment of science is communicated in varying degrees by stakeholders within the community and the appearance of an innovative and purposeful science curriculum exists, the indicators of culture in this research (values, beliefs, practice, materials, and problems) paint a contrasting picture.

In order to address the research questions, data were gathered and triangulated from three sources: individual semi-structured participant interviews, informal observation of the school environment, and artifact/document collection. These data were analyzed in light of the research questions and in accordance with the theoretical framework outlined in Chapter Two and Chapter Three. Recall that the main research question of this study asked: How does school culture (its values, beliefs, practices, materials, and problems) influence effective science instruction?

This study was additionally guided by four secondary research questions that articulated the nature of the relationship of cultural indicators to the core research question. While these questions are supported by subsequent data and analysis in this

chapter, an overview of the secondary research questions and their findings are noted here. This study suggests the following assertions:

- 1) How does the Integrated Thematic Instruction model (ITI), along with the magnet structure of the school influence the teachers' science teaching? (practice)

Assertion One: The appearance of constructivist actions and the guise of innovation provided by the ITI model and the magnet structure give stakeholders within in the school community confidence that they are consistently delivering high-quality education through innovative and constructivist means. While the school is successful in areas such as reading and mathematics, the appearance of innovation and science-like activities, are routinely substituted as effective science instruction at Happy Valley.

- 2) How do the values and beliefs teachers express influence the teaching of effective science? (values & beliefs)

Assertion Two: The curricular freedoms within the magnet structure allow for the individual values and beliefs of the teacher to set the tone for the content and instruction that is delivered there. Teachers are encouraged to develop curriculum that complements their selected magnet and meet the innovation ideals of the collective school community. Since three of the four magnets are non-science related

this contributes to the disregard for effective science teaching and may also allow for the complete amnesty for the lack of science instruction.

3) How do available materials & resources influence the teachers' science education practice? (materials)

Assertion Three: An abundance of science materials are available at Happy Valley but plays little role in contributing to effective science teaching. Teachers, aware of their location and availability but having other curricular goals and priorities, choose not to utilize the materials for use in their own classrooms. While an impressive science lab space exists, the space and its instruction are seen merely as an activity stop on the students' weekly wheel. For some teachers, this becomes the sole provider of science instruction for their students.

4) How do the perceived problems of teachers influence effective science instruction? (problems)

Assertion Four: At Happy Valley, perceived problems with science are not problematic to teachers in the classroom since the majority of their values and beliefs are focused towards the implementation of ITI or in their specific curricular area of interest. Additionally, strong problems are reported in regards to administration of the magnet departments and their desire to be distinctive from other public schools.

### Key Informants

Teachers, selected as key informants, were asked to comment and discuss their science teaching during semi-structured interviews. They provided insight and examples of their experiences and practices in their daily science instruction. Teachers spoke candidly about values and beliefs, their perception of their science instruction, access to materials and resources, and their perceived problems. I introduce them here (using pseudonyms) to set a personal tone prior to the investigation of the research questions.

#### *Ms. Welshimer*

Ms. Welshimer is a firm believer in the Integrated Thematic Instruction reform initiative. Through ITI she comments that she integrates much of her instruction. She perceives herself to be comfortable in the area of science and specifically the integration of science within her day. She comments on the use of hands-on, minds-on instruction with her primary students. She feels she has easy access to the science lab and its materials, which she believes to be in abundance. She acknowledges the science standards that she is required to teach but is at ease with this requirement and doesn't see it as a forced topic from her administration. Books abound in the classroom. A small goldfish bowl filled with water and plants adorn each cluster of student desks. Some science content posters are seen in the room.

Ms. Welshimer is unable to estimate the amount of time that she spends on science instruction since she often combines science and literacy instruction. She feels that she is sufficiently integrated to the point that she is teaching science in many given

sections of the day. She adds that certainly, “once a week” they are devoted to direct science instruction. Her class spends an entire nine weeks in the School of Math and Science which she believes provides her students with a concentrated dose of science. Ms. Welshimer feels that she is very focused during this time and that this nine-week period provides the students with an adequate overview of the science curriculum for her grade level.

*Ms. Sutton*

Ms. Sutton is a veteran teacher and teaches in an intermediate classroom. Ms. Sutton believes in the progressive climate of her classroom and the innovative lessons and role-playing activities they do. She feels that integration of subjects is important and especially the areas of social studies and science. Her curriculum consists of a non-textbook approach and uses local resources (parks & recreation) to support her science instruction. She discourages the use of an established daily science time and likens herself to a more flexible schedule similar to the “block.” She is content about her magnet choice and appreciates the extra magnet lab time that is allowed. Her room consists of clustered table arrangements and exposed materials are related to content areas other than science.

Ms. Sutton feels that she has adequate access to the lab and utilizes the resources in it. Her students also rotate through the science lab class once a week. She notes the importance of “hands-on” and assesses student learning through rubrics and her own

developed assessments. She prefers to avoid traditional test taking materials and expressed her displeasure with the district mandated science assessments.

*Ms. Webb*

Ms. Webb teaches all subjects to an intermediate grade level. Her classroom consists of clustered student desks, an overhead, and a large collection of classroom science materials. Ms. Webb supports the ITI model and believes it allows her to teach exceptional science. She presents weekly experiments, mixed science and math dilemmas, and is consistently exploring data with her students. Ms. Webb prefers to tailor her science instruction to the Sunshine State Standards and uses the textbook as a reference tool only. Ms. Webb utilizes a large collection of personal science equipment as well as the science lab and its materials. She incorporates a “hands-on” atmosphere with her students and creates themes for instructional units.

Ms. Webb is sought out as a resource in science and considered the local expert when the need arises. Ms. Webb is discouraged by her feelings that the rest of the school doesn't have an interest in science. On a recent occasion, Ms. Webb invited primary classes to visit a classroom display of an experiment, while teachers appeared to be interested, no classrooms arrived for a visit.

*Ms. Kegley*

Ms. Kegley is a primary teacher and experiences each magnet program for one nine weeks period out of the year on a rotational schedule. Ms. Kegley is personally interested in science. Her classroom consists of science content posters, books, and some

experiment materials. Ms. Kegley feels that finding the time to teach science is the challenge; therefore she attempts to integrate her science with reading whenever possible. Ms. Kegley believes in the value and importance of “hands-on” science instruction and suggests that she is sometimes hindered when doing a hands-on demonstration lesson as there is not enough materials for all the students to do it.

Ms. Kegley feels that the magnet structure controls the value and focus for the students throughout the year but that she attempts to continue her science teaching even when she is not “in” the School of Math and Science. In regards to the whole school, Ms. Kegley does not feel that the school places a large priority on science and her impression is that most teachers do not like to teach science at all. She also feels that same grade level planning would be more beneficial to her than the current K-3 pod planning structure.

*Ms. Quillen*

Ms. Quillen is an esteemed member of the teaching faculty and is known for her deep understanding of the teaching of reading. Ms. Quillen is keenly aware of her disposition and treatment of science throughout her years as a teacher in the school. Without hesitation, Ms. Quillen views her science instruction as weak and at times even ignored.

Ms. Quillen expressed her relief in this area noting the high levels of guilt she has harbored during this time and prompted her recent choice to take additional courses. Ms. Quillen felt that her intermediate placement in a devoted magnet area released her from

her obligation to teach science well. Ms. Quillen expressed that one or two teachers were at her disposal to assist in science and that she utilized them occasionally and replicated many of their lessons. She felt that materials were available and readily accessible if she wanted and that her students participated in the science lab once a week during specific quarters of the school year. Her classroom has few examples of science content or materials.

*Ms. Seeger*

Ms. Seeger is a veteran, intermediate teacher and is highly regarded by her colleagues for her extraordinary use of ITI in her classroom. Her classroom décor (highly themed within her yearly ITI design) is often the talk of the school and her classroom is usually a favorite stop on school tours. Ms. Seeger chooses to rely on the textbook for her science instruction but notes that she doesn't stick with it heavily. Ms. Seeger utilizes the Internet, trade books, encyclopedias, National Geographic, and other things that she feels she can get her hands on to teach science.

She believes that she has some access to materials but would like to know what actually is available in the science lab to check out (inventory). She notes that she has checked out materials at times. She feels that hands-on instruction is a good way to teach science to children and comments that she needs to do more. She feels the ITI reform program allows her to go in depth with her themes which she admits she goes "heads over heels" into. Ms. Seeger is concerned that her magnet demands much instructional time. She has general concerns and problems with the amount of time that her students



are pulled out of her classroom to attend magnet focused activities. In her planning, science is often the first to be removed from what is an already demanding schedule.

### Significance of the ITI Model and Magnet Structure

This section discusses the significance of both the ITI reform model and the magnet structure of the school. This information was critical in addressing the cultural indicator of practice that was imbedded within question one of the secondary research questions. That question was:

- How does the Integrated Thematic Instruction model (ITI), along with the magnet structure of the school influence the teachers' science teaching?

### *Magnet Structure*

As noted earlier, teachers at Happy Valley participate in a unique school infrastructure unlike many mainstream public elementary schools. In grades K-3, students spend time in each magnet over the course of the year (utilizing each magnet for nine-week durations). This is known as “traveling through the magnets”. At the end of grade three students are asked to self-select their top choices for magnet membership. If their first choice cannot be accommodated (typically due to classroom size) they are assigned their second choice. Figure 1 illustrates the progression of students from primary to intermediate grades and the relationship of the four magnets.

Once accepted into their magnet choice at the end of third grade, the students spend the duration of fourth, fifth, and sixth grades in that magnet exclusively. Students

travel with the same peers for the duration of fourth, fifth, and sixth grades. This magnet structure greatly impacts the direction and actions of the entire school population. It is part of the everyday rhetoric of administrators, teachers, parents, and students.

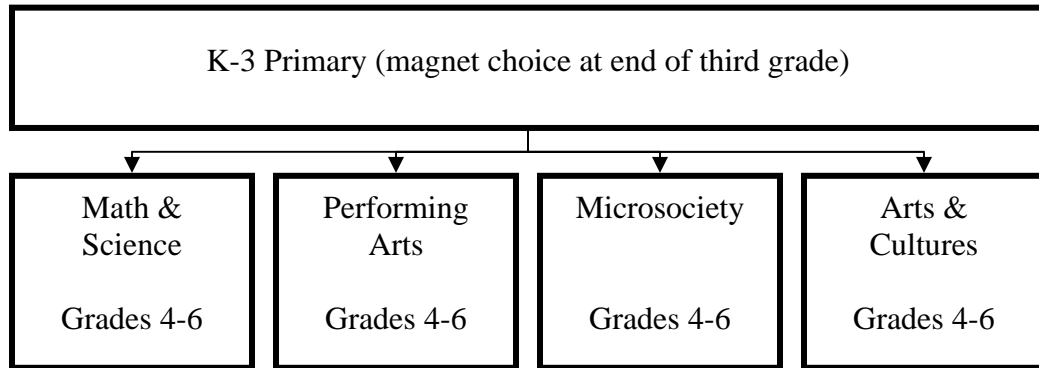


Figure 1 Student progression plan.

### *Integrated Thematic Instruction (ITI) Reform Model*

Some readers may be unfamiliar with the comprehensive school reform model that is supported at Happy Valley. This section will attempt to describe the characteristics of the whole school curricular program. At Happy Valley, all teachers are expected to plan their classrooms, curriculums, and instruction in accordance with the guidelines set forth in the ITI model. Each year, teachers are required to develop a yearlong curriculum plan with their “lead” teacher (a pseudo-administration position). The yearlong theme represents the path students will take in their curriculum and is complementary to their magnet curriculum areas. It is visibly posted in their classroom

and referred to as the year progresses. Most students can quickly tell you their classroom's specific theme.

The ITI reform program directs that teachers create specific physical environments in their classroom spaces. At the case school, classroom environments are welcoming, aesthetic, and are generally liked by students. Classrooms are decorated with a "cozy, at home" feeling. Desks or tables are clustered into small workgroups in contrast to traditional rows of student desks. The teacher's desk finds another home away from traditional placement and is secluded within the design of the room. Many rooms are equipped with old couches, chairs, rocking chairs, end tables, lamps, and plants similar to a living room.

Elaborate rooms exist within the school. Walking into these rooms you may feel that you have just visited an intricate theme park. One room consists of surfboards attached to the walls that support the teacher's "Hawaiian theme." In this classroom, students routinely sit on the floor (in lieu of chairs) as one might do in an island tradition. In another room, a jolly roger is prominently displayed as part of the teacher's pirate themed environment. An intermediate classroom proudly displays its collection of tap shoes and Broadway production sets as part of its classroom environment. One classroom spent a year painted black to encourage a teacher's astronomy themed environment.

This enhanced environment also has other characteristics. Students are encouraged to remain hydrated, snack, and exercise brain-gym movements within the day. It is not uncommon to see water bottles littering desktops, a guaranteed and

orchestrated mid-morning snack time, and frequent “brain” breaks. Each and every classroom has two areas of wall space that are devoted to the teacher’s yearlong theme and the display of character building, “Lifeskills.” Both of these displays remain for the whole school year.

Each magnet also possesses lab space for its own magnet uses. The lab space hosts a variety of specials during the week (such as the keyboard lab), community activities specific to the magnet, or it can also be reserved by teachers for individual use. The school has its own bank, TV studio, black box theatre, assorted shops, post office, ticket booth, recycling center, as well as other unique areas. Lab space, however, is not completely equal from magnet to magnet. One magnet has four distinctly different lab spaces, while others make use of approximately two, and one magnet has no additional lab space to specifically call its own.

Generally, most teachers practice a low-level application of the reform program. More advanced levels of ITI that occur across the nation require the development of conceptual key points and elaborate, in-depth, curriculum planning. However, only two to five teachers at the case school operate on this level. One teacher commented that if she was forced to participate at the advanced level she would feel deterred from good teaching.

### *Instructional Time for Science*

As other public elementary schools, teachers at the case school are required to teach all of the Sunshine State Standards. The fluid and constructivist nature of the ITI

program discourages the routine “classroom schedule” and instead encourages teachers to vary the day-to-day schedule to accommodate the learning goals for the day. Therefore, most teachers do not have a consistent daily schedule other than their dedicated specials time or lunch. Students arrive to an agenda posted on the board that lays out the day’s schedule and activities. As an example, on Tuesday the math lesson may begin at 10:00 and Thursday it may begin at 1:15 in conjunction with a social studies lesson. Integrated lessons are greatly encouraged and expected.

A large amount of instructional time during the day is spent devoted to specific magnet activities. As an example, the Performing Arts magnet houses a thirty-member elite singing and dance team that practices both in and out of school and keeps a rigorous performance schedule. Similarly, the Microsociety magnet has common community times where businesses, banks, post-offices, and the criminal court open up for business. Here, all students fourth through sixth grades (belonging to that magnet) meet and role-play their respective jobs be it banker, lawyer, roving hall monitor (policemen) or the beautification “clean-up” crew for the greater school community. The time for these activities is not in addition to the regular school day. It happens within it. Some teachers respond negatively to these increased times when they feel that their individual classroom time is being taken up. One teacher commented that students left her class to participate in an off campus “non-academic” event related to the magnet.

In regards to effective science instruction, key informants suggested that they do feel that they teach science as part of their schedule and yearly obligations. Only one teacher responded that for her, science instruction was often ignored. Most of the

participants felt that they did a good job teaching science. While each teacher had an explanation of her science practice, the time allotted to the teaching of science was varied and inconsistent. Ms. Welshimer was unable to determine how much time that she did spend on science, mostly suggesting that the integrated structure of her instruction didn't allow her to comment on a specific devoted time frame for science instruction. She decides what science topics she would like to teach and integrates them into her yearlong theme with some guiding units determined "by testing" she says. She comments on her hands-on instruction, experiments, and her use of manipulatives.

As a primary teacher, her students spend nine weeks in the Math and Science magnet. During this time she feels she accomplishes the majority of her science teaching, "we kind of focus our second nine weeks mostly on science and I was in the lab at least twice a week with the lab teacher and I also did a lot of it in my classroom." She continues her praise of the magnet structure and its devoted time to science:

Since we have the one nine weeks it really makes me focus a lot instead of spreading it out over the whole year. I think more of that focus within those weeks really helped the kids to stay on top of what we are talking about and I think I do more.

Ms. Sutton, an intermediate teacher, also is unable to directly note her practice and suggests that her science teaching is "all integrated in the theme" she adds that certainly students receive three hours of science instruction each week.

Researcher: Do you teach science everyday?

Ms. Sutton: To sit there and say that it is science time, no, to say, “everybody it’s science get your books” – I guess I lean more to going back to like the block schedule. Definitely every week they are getting maybe three hours of science in some way.

Ms. Sutton considers her science instruction to be developmentally tailored to her students in her magnet. She prides herself on her ability to use the life sciences and environmental sciences. Her instruction includes a variety of field trips and experiments such as the use of aquariums set up in the back of her classroom. An integrated instruction fan, she comments that she has to thematically teach science with the other content areas, “That is the only way.”

While the majority of teachers at the case school echoed similar sentiments about their science instruction time, one teacher, commented on the specific attributes of her daily science teaching. Using journals and a science problem of the day, Ms. Webb begins each day’s science instruction with a science experiment or the continuation of a science experiment from the day before. She comments that it might be said that other subjects like reading and writing receive less attention in her class than others because of their intense focus on science. While Ms. Webb provided the rhetoric for what she does in her classroom she also provides lengthy explanations of specific science content that her students encountered. This was in deep contrast to other teachers in the study who offered science-like activities and project ideas only.

For another primary teacher, Ms. Kegley, science instruction spans the whole year, although her increased involvement in the other magnets each quarter does take

priority. She likes to begin her instruction by modeling an experiment and then hosting “science centers” around the room with a stapled packet of “work” to be completed. She allows her science instruction to be guided by the Sunshine State Standards and feels her instruction is hands-on and engaging. Similar to her colleagues, she praises the integrated structure of the school:

Researcher: How does ITI affect your teaching of science?

Ms. Kegley: I like ITI because, when I sit down (and I actually haven’t written my curriculum for ITI yet) but – I have mapped it out and I use my Sunshine State Standards and science and social studies as well. I use those to kind of bring in all the other concepts. So they are my foundation. The science skills - I usually lean towards science more because I do enjoy science more than social studies, but you know, I think that everything is science related so you can incorporate science in every single subject area and then other subject areas into science so it is easier to use science as the foundation.

Ms. Seeger, an intermediate teacher, comments that she does use the science textbook although she doesn’t always stick to it heavily. Because of the recent increased pressures she attempts to teach science everyday but suggested that it really only happens two or three times a week. While she doesn’t feel that her magnet membership helps at all in the teaching of science, she feels that the use of the integrated structure is profitable.



Overall, participant responses suggest that there is little structured time in the day for the specific, direct instruction of science. Further, the time that could be devoted to the teaching of science is consumed by specific magnet activities.

### *Instructional Practices in Science*

When teachers at Happy Valley do teach science they cite their use of models, aquariums, garden planting, and similar science-like activities as evidence of how they teach science. Throughout the study only one teacher offered to explain her justifications for her science experiments as the method for teaching about the processes of science and the nature of science. Most of the teachers seemed to unknowingly offer “science like” experiences in lieu of true science teaching. Having done these experiences they felt confident that they had provided the students with constructivist discovery learning consistent with the school philosophy.

Rhetoric for what teachers feel is adequate science instruction was also common amongst the teachers. Teachers operate under a school philosophy and motto that states, “Where innovation is a tradition.” Direct science instruction, if attempted, is easily lost within their yearlong themes that treat only the surface characteristics of science activities. If it appeared to be hands-on, free from a textbook, innovative, and fun the experience would pass as a science lesson. Take for example a lesson from an intermediate teacher, “Most everything was project oriented. The kids, they invented boats you know -- and we would race them to see who did the best one. They did measuring with water and everything.”

In pursuit of the constructivist agenda, teachers comment enthusiastically on their use of hands-on, minds-on activities. They also cite the usage of field trips or “being there” experiences (a main tenant of the ITI program). While the circumstantial evidence of science exists in things like aquariums, student science lab coats, and large-scale space shuttles built outside, little evidence is apparent to suggest more than this superficial treatment of science activities.

Direct science instruction that does occur consistently in the school can be found in the science lab. As noted earlier the science lab is a space that belongs to the School of Math and Science. However, for 90% of the week the room is utilized to serve as a “special” on the activity wheel. This provides a time for teachers to take their planning period and functions as any other special would similar to music or art. Students travel in their class to the lab about once a week for forty minutes. Here a lab instructor provides a brief hands-on activity. Of interesting note, the lab instructor is an instructional assistant not certified to teach in the elementary classroom. Instructional assistants are a valuable and visible position within the structure of schools but their duties traditionally consist of small group instruction, assistance within a teacher’s classroom, or in other capacities. For an instructional assistant to serve as the instructional lead within a class – regardless of how competent or capable they are is rare. At the case school this instructional assistant is regarded highly by the faculty. A previous parent of students who attended the school, teachers respond positively to her and have high regards towards her as the instructional teacher in the lab space.

### *Summary and Discussion of Findings*

When looking at the influence the ITI model and the magnet structure has on the science instructional practice of the case school, I strongly suggest that the implications are of great consequence to the teaching of science. The appearance of constructivist actions and the guise of innovation provided by the ITI model and the magnet structure give stakeholders within in the school community confidence that they are consistently delivering high-quality education through innovative and constructivist means. While the school is successful in areas such as reading and mathematics, the appearance of innovation and science-like activities, are routinely substituted as effective science instruction at Happy Valley.

At Happy Valley, the appearance of innovation is praised, encouraged, and routinely expected. The adoption of the ITI model and the magnet structure of the school support this desire for constructivist behavior and provide the school a federally accepted reform model to stand behind. From the design of the classroom to the language spoken by the teachers, a desire to be constructivist-minded and an innovator are truly desired. The majority of teachers desire to improve in their constructivist craft and participate in professional development in the reform model. They believe that there is “no other way” to teach and that they are doing a good job at it currently. In regards to the teaching of science only one teacher explained her displeasure with her science teaching and its effectiveness. This teacher also carried strong beliefs about the “keeping of appearances” for the sake of the school:

At Happy Valley, I guess they value...if you sat in faculty meetings and listened to the principal at the time you really felt like it was important, brain based principles aligned that definitely that was their language ...I think the school values things that make the school look good...If you were behaving in a way that was appropriate to what you were teaching and you made the school look good – I think you were fine.

Participants consistently referred to their more “empowered method” of teaching that the school and the ITI program allows them to participate in. There is little regard for traditional appearances and some participants were quick to discuss why teachers of a more traditional nature possibly had their days at the school numbered. Ms. Sutton speaks to this, “though they say that it is and we are doing some things toward ITI, I see that we are losing some of that. I’ve also seen a little more traditional type teacher here. Teachers that might not be as committed or realizing what the magnet program is.”

Another teacher agrees:

You know, you’ve been here for five years get your theme together or at least – they’re not pushing it in a mean way but, hey we need to start seeing some progress here or else maybe this isn’t the school for you and I think that’s a good thing.

Instructional methods also carry this message. At the case school the use of textbooks is acceptable when used as a “tool.” Teachers are focused on providing being-there experiences for students, using hands-on activities, and initiating project-based assignments. Again, the majority of the teachers felt that they did all of these things and

with competency. One teacher describes her hands-on science to be the use of aquariums within the room while another teacher describes her hands-on science lesson as the racing of sailboats on water. A teacher builds a model of the space shuttle outside to teach science and yet another teacher conducts a classroom demonstration as her “hands-on” lesson. The rhetoric of the constructivist philosophy is very evident. Participants utilized the phrase “hands-on” within their interviews and in differing definitions. Many other buzzwords were also used: brain-friendly, brain-compatible, integrated, experiments, cadres, inquiry, manipulative, lab sheets, immersing the children in learning, and so on.

Many teachers were adamant that their school and their teaching was “different” and that often this “difference” would be their reasoning for not strictly adhering to some district directions that seem counter to their “innovative, magnet school.” One teacher began to discuss how the district had expected classrooms to set aside ninety minutes for the daily reading block. Her response to this “traditional mandate” was, “you know now they want us to have a 90 minute reading block – but to me, we are reading all day long anyway, so I can’t see that that makes a huge difference.”

School publications also proclaimed the innovative nature of the school. One monthly newsletter sent home with students was creatively produced. It regularly featured science rhetoric regarding the brain-friendly nature of the school and its research based impact on students. Take for instance several excerpts (Figure 4, 5, and 6) where the use of advanced microscopes in kindergarten is applauded, the neurological implications of science and music is noted, and the newest technology to hit the school

science lab has arrived. Headlines and captions also provide evidence for the school's self-perceived science innovation. They include:

- Happy Valley, “A National Blue Ribbon School of Excellence”
- The event inaugurated the new science lab.
- “Newest Technology Engages Students”
- For more innovations in technology here at Happy Valley see pages 4 &5.

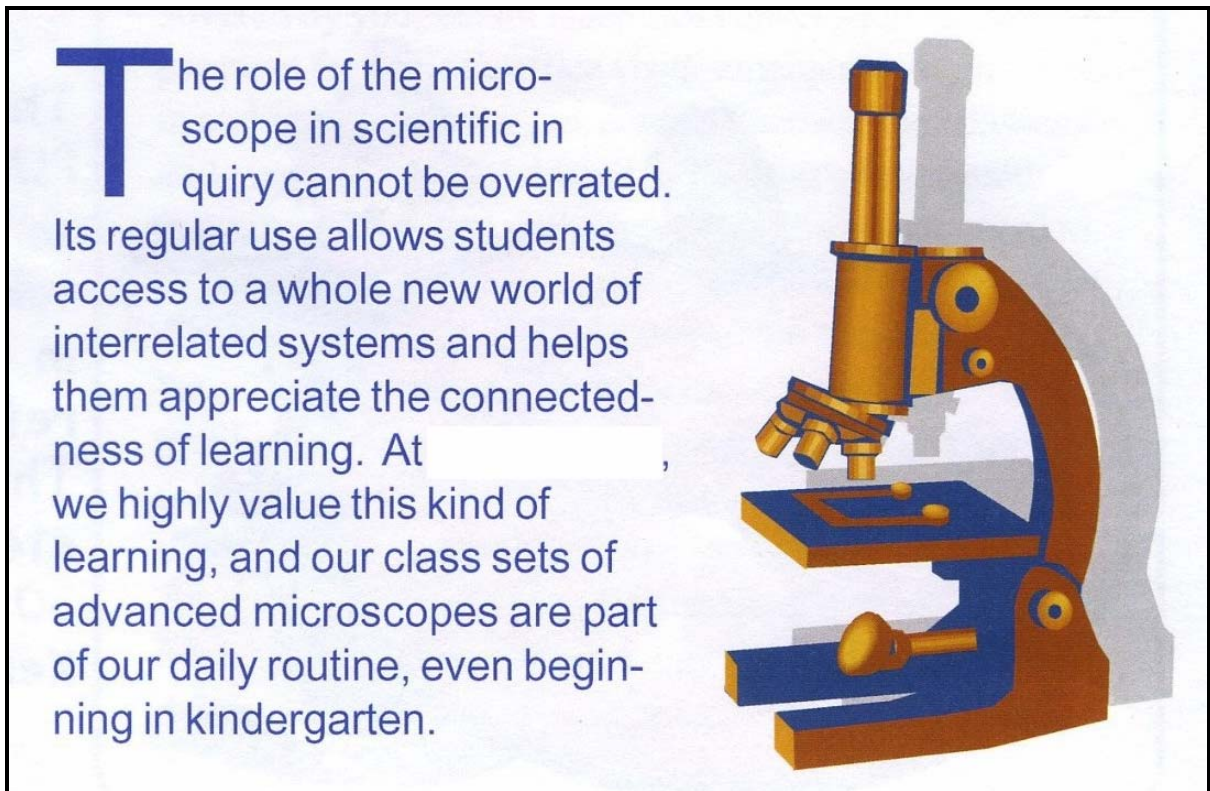


Figure 2 Newsletter Excerpt – Microscopes and Kindergarten



**MUSIC & SCIENCE** stimulate the brain and help produce what neuroscientists call “flow,” when the mind is in a state of relaxed alertness. Colleges are beginning to catch on to this research in action and are actively seeking out students who have resumes beyond standardized tests and exemplary experiences beyond pencil and paper.

Figure 3 Newsletter Excerpt – Music and Neurological “flow”



## Newest Technology Engages Students

Dear Family,

\_\_\_\_\_ was recently awarded two grants to provide microscopes for all students to use in the Math and Science lab.

The BEST (Brevard Excellence in Science & Technology) grant provided compound microscopes for our lab. Compound microscopes enable students entry into a world of crystals, cells, and unicellular organisms. Our intermediate students have already studied onion cells by preparing and staining the cells.

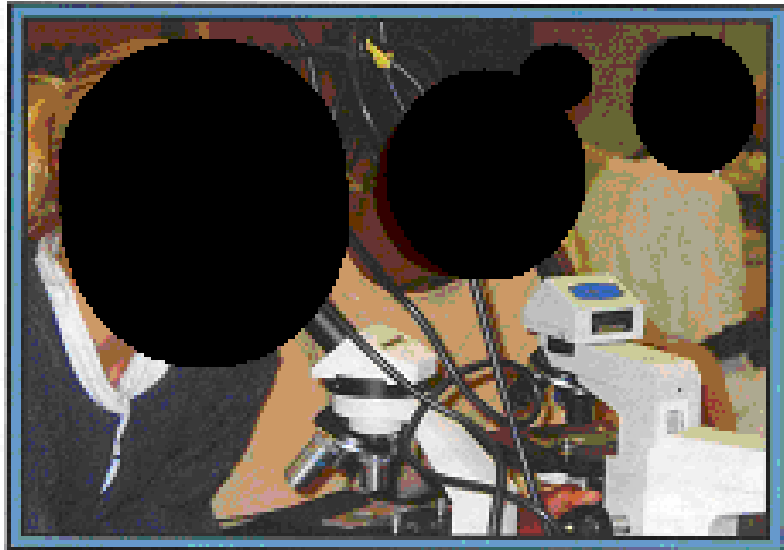
\_\_\_\_\_ was also awarded a one thousand dollar grant from the Boeing Company to provide new equipment for our Math and Science Lab. We started with our new program, "Up Close with Stereoscopes," at the beginning of our new school year. Stereoscopes are particularly valuable - and rare - in an elementary school. Students enjoy bringing in a variety of specimens to observe daily. This type of scope allows children to look at larger items, such as fingers, rocks, insects, leaves, flowers, papers, and cloth. By looking through the eyepiece, the common object appears 30 times larger and new details become obvious. This fascinating way of seeing the world with new eyes is often enough to spark an interest in science which did not previously exist. We now have enough high quality stereoscopes for each student to enjoy "SuperSight".

Math & Science Teacher \_\_\_\_\_ reports, "We're very pleased that each and every student at \_\_\_\_\_ will have the opportunity to get *Up Close with Stereoscopes* in our Math and Science Lab. Our deepest thanks to Boeing Co. and BEST for supporting education and science at \_\_\_\_\_. For more innovations in technology here at \_\_\_\_\_, see pages 4 & 5."

Sincerely,



Principal



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One element that adds to the innovative appearance of the school is the newly built science lab. While the concept of the science lab had existed for some time at the case school (previously housed in the older section of the building) the recent structure built to replace district portable classrooms was selected to house the new science lab space. The lab is fully stocked with video screens, projection systems, smart board technology, lab tables, lecture space, a collection of microscopes and a myriad of math and science manipulatives. With its design and furnishings the lab supports the progressive, constructivist, innovative appearance of the school and is often photographed and used for guest speakers and the like. It is a common stop on the school tour route. The staffing of a “science instructor” within the lab also allows the school to profess its values and beliefs in the additional instruction in science for its students. The school with its proclaimed deep devotion and convictions to the constructivist agenda asserts itself with its extra emphasis on science in the form of the innovative lab space and dedicated instructor (an instructional assistant).

For primary teachers, the magnet program allowed for the quick treatment of science during one nine-week period that the class was visiting the math and science magnet. Primary teachers felt that they were able to dig deep and devote large blocks of time to science during these nine weeks and had wider science instruction from the use of the science lab and instructional support there. However, once the nine-weeks were over, the class was forced to move to another magnet and devote the entirety of their time to the new program. Some teachers continued to teach science outside of the magnet but this instruction became sporadic. One teacher explained her frustration when denied

science materials for a lesson she desired to teach outside of the magnet schedule.

However, had her primary students been traveling through the math and science magnet her request would have been granted.

Ultimately, the structure of the magnet programs allowed poor teachers of science (and other teachers) to hide behind the perceived science innovation of the school. Able to hide behind their yearlong themes that had cursory science thrown in for good measure, the magnet structured unwittingly allowed teachers to only teach what they felt was necessary or things they were personally vested in. More often than not, this was reading, mathematics, and the magnet program goals. Science was routinely lost in the shuffle and when it did appear was one-dimensional, somewhat shallow, and offered only the perception of innovation.

### Significance of Teacher Values and Beliefs

Teacher practice, we know, is a deeply rooted product of a person's specific values and beliefs. The next secondary research question targeted the cultural indicators of values and beliefs. Hence, I address my second research question within this section.

The question is:

- How do the values and beliefs teachers express affect their science teaching?

### *Beliefs In Pursuit of Best Practice*

Teachers in the case study are quick and eager to discuss why they teach science the way that they do. Of fundamental significance is an understanding that these teachers

believe that they are truly teaching “best practice” science. They pursue a constructivist appearance and strive to be “brain-friendly” and “brain-compatible.” While only one teacher commented that her science instruction was meager, other teachers in the study celebrated their own teaching of science with thanks given to the constructivist philosophy and ITI structure that they and the school hold. Ms. Welshimer, a founding member of the school’s reform initiatives suggested that she wouldn’t be able to teach in other ways, “It would be very hard for me to teach traditionally because immersing the children in what they are learning is the best way to go.” Ms. Sutton agrees:

I think there is actually a lot of science happening at this school, intentionally, I don’t know (laughter) but a lot of science is happening. It is like even for me to think about the magnet – when you start thinking about the kids planning a garden I don’t say that’s science – but it is, you know.

Teachers believed that the ITI structure provided them the opportunity to dive deeper into science topics with their students. Ms. Sutton suggests, “It allows me and students to have more time to work on anything to understand – they get a deeper understanding of something – they do in depth.” Teachers believe that the school is innovative in its design and that the innovation provides them the satisfaction that they were teaching in a constructivist manner that was best for students - a manner that they value. One teacher explained:

The thing that I think this school focuses on and I think one of the things that made me proud to be here is that it focused on each students doing the best that they can do – whatever that was ... You don’t see that in other places – you don’t

see all the sides of a kid in other places because they are focused on “sit in the chair” you know.

Teachers commented on the divide of trying to teach in the way that they believe is “best for kids” and still meet district and state mandates. Ms. Sutton adds, “I do feel really stressed about it. I feel pressured into using the textbook by the district. I feel great pressure. But I’ve resisted it (laughter) I don’t know how much longer I can resist them.” Teachers also noted the strong set of values and beliefs that guide their teaching, and specifically their teaching of science. Ms. Welshimer explains:

Researcher: How do you know that students have learned the material that you set out to teach in your science time?

Ms. Welshimer: Well, actually I do a lot of experiments. I don’t really believe in a lot of the testing that we do, but my observation mostly is how I can tell and I let my kids work in a lot of groups and they can discuss with each other and with me. (Pause) A lot of hands-on and then doing some lab worksheets that we have done in the lab and then here and just seeing how they explain how the experiment worked. Really it is open-ended questions a lot, more so that just giving them the test that is multiple choices.

Ms. Suttons adds:

I think I'm going to change how I teach a lot next year because when I first started here I did a lot of hands on, a lot. I mean everything...I just haven't done that because each year I just feel overwhelmed by all these different assessments and I get confused about what the administrator really wants but I'm going to change

because I can feel the kids - for what I've done this year with textbooks it just doesn't work...So I'm just going to go with how I think. That's my feeling on it.

### *Beliefs About Testing and District Assessments*

Teachers spoke adamantly in their disapproval of the state standardized testing system and specifically the weight it carries with it. Teachers, not necessarily against the *intentions* of the test cautioned that the current *implications* of the test did not align with their beliefs or values about education. While teachers responded that the FCAT test did not align with their beliefs they did acknowledge that they were obligated as employees of the school system to prepare their children for the assessment. Every participant spoke to the topic of the FCAT at some point during the interview.

Similarly, they commented on the district science assessments that they were obligated to provide. However, some teachers chose to alter the procedure for the administration of the district assessment and would cram information right up to the very last minute, only teach what was on the test, or even allow the students to work on the test in groups and with open science textbooks.

Researcher: Do you incorporate the district science assessments?

Teacher: Do I incorporate them? You mean do I give them (laughter)? Let's see... (laughter) um, I've done it many different ways. I've done it where I've given the district assessment into groups just because it is required and I've had kids sit down and take the district assessment and open book test -- this year, I'm having a really hard time with it because I don't really believe in it. I did give the

assessments -- I just finished doing D or F I guess, whatever, but it was open book because the assessment is linked to the textbook and it is required by the district to put it into their cumulative folders -- they require it so I have no choice but to give it.

In some instances, teachers responded that their values and beliefs would allow them to go against the district policy in procedures. When asked about her science teaching and the science pacing guide developed by the district one teacher responded:

I'm not going in order, which is really against the county because I mean I worked with the district and I know that they are really big proponents - they want you to go in a sequential order because we have such a transient rate so that you know the kids aren't having holes in their instruction...the nature of science I am teaching all year - when my kids leave here they know the nature of science.

### *Summary and Discussion of Findings*

Good educators are aware that in planning and delivering instruction we teach what is valued by us or more often, what is monitored. Consequently, the values and beliefs of teachers will determine the extent to which science is taught in the elementary school. At Happy Valley, curricular freedoms are substantial. The curricular freedoms within the magnet structure allow for the individual values and beliefs of the teacher to set the tone for the content and instruction that is delivered there. Teachers are encouraged to develop curriculum that complements their selected magnet and meet the innovative ideals of the collective school community. Since three of the four magnets are

non-science related this contributes to the disregard for effective science teaching and may also allow for the complete amnesty for the lack of science instruction.

Watters and Ginns (2000) suggest that at the core of making science meaningful for children are the initiatives and actions of the classroom teacher. Teachers, they insist, must be capable of responding to societal expectations, professional changes, and introduction of new science curricular reforms. Specifically, they must be able to respond to the new science directions pointing towards the education of children in becoming scientifically literate, socially aware, and lifelong learners. Educators at the case school carry a genuine heart and sincere educational philosophy for the learning of its students. Many teachers spend time out of school, often at home and on weekends, preparing for their lessons and are sincerely invested in their students. They are good-natured, intelligent, and responsive faculty members.

Regardless, specific structures within the school limit and quite often, pardon the quality instruction of science. Teachers at Happy Valley believe that how they teach and what they teach is truly best for students. As a whole, they strongly believe that the ITI program is the “only” way to teach. Magnet membership plays a large role in the treatment of science. At Happy Valley, the majority of intermediate teachers are personally interested and motivated by the topics and magnet focus they were hired to teach. The Performing Arts faculty carries with them a love for the arts, dance, and performance. The Microsociety faculty shares with its students their love for civics, government, and economics. Likewise, the Arts and Culture faculty spends their free time devoted to artistic endeavors and the celebration of multicultural America. The

Math and Science faculty relishes its time to develop new science experiments, compute numbers, and make sense of complex problem solving.

While these elementary teachers are often perfect fits for their magnet programs the original intent of the magnet structure was to engage students with the magnet focus and draw them into the teaching of the Sunshine State Standards in all subjects like any other public school is required to do. This study suggests that the use of the magnet structure could possibly place constraints on academic teaching time and topics, especially if the magnet topics are not directly related to core school subject areas. At Happy Valley this structure left little time in the day for instruction outside of reading, math, and the “magnet.” For science, this became the problem with three magnets whose focus is not related to the teaching of science. In their magnet pursuits for the Performing Arts, Arts and Cultures, and Microsociety the time simply did not exist to teach science effectively. For teachers, who didn’t personally value the teaching of some science to begin with – the consequences are doubled.

All the teachers in the study responded that they did teach some elements related to the science curriculum, however, most responded that this was included in their hands-on, integrated lessons. This became a perplexing notion as teachers said they participated in innovative science instruction when in actuality they treated science with superficial, more traditional, textbook driven science lessons. Some teachers were forthcoming with their lack of time to devote to science. It appeared that this was an acceptable practice to “trade-off” the in-depth, focused, teaching of science for the more accepted magnet practices.



The usage and treatment of the science lab is also worthy of discussion as it highlights a commonly held belief that the lab provided sufficient science instruction that allowed teachers to conclude that they did not need to teach it in their own classrooms. With intermediate students traveling the science lab on the wheel, once weekly, some teachers were assumed to be leaving their science instruction up to the lab. Teachers could become complacent knowing that the science lab was there to provide some element of instruction, thereby releasing them from the responsibility or the guilt of not feeling prepared to teach science well. Some key informants supported this notion that teachers utilized the lab in lieu of their science instruction. One teacher suggested that it was specifically stated to her that they were happy the lab was teaching science because they don't do that in their classroom.

Finally, teachers were content to sing the praises of ITI as their personal value and beliefs systems were challenged by the accountability of standardized testing. Believing that they were acting in the best interest of students, they were able to disregard procedures and assessments supplied by the state and district in the teaching of science. Their values and beliefs about the constructivist nature of learning was an additional open freedom to professional decision making in the classroom and specifically in the area of science.

### Significance of Materials and Resources

When teachers begin to plan instruction one vital step is in the accessibility, gathering, and use of materials. This section discusses the relationship of materials and its influence on effective science teaching. The third research sub question inquired:

- How do available materials and resources influence teachers' science education practice?

### *Materials Abound*

A large collection of materials is available and housed within the science lab and made available to teachers to use there or to check out to their classrooms. Teachers in the study responded positively about their access to these science materials to support their instruction. All teachers were aware of location of the materials, the procedures to check out those materials, and the personnel that staffs the science lab.

Ms. Welshimer: We have a science lab here, you know I use a lot of manipulatives and different things they have out in the science lab and they are really good about letting us check things out and either bring them to the classroom or use the lab.

Ms. Quillen: At Happy Valley the materials are so fabulous. Whatever you wanted to do they had the materials for you and it was so nicely organized, it was neat and a friendly environment, a clear setting and you know you could go to them for help.

Ms. Sutton: This set up is totally different. This is a very clean lab, you know, they had lots of nice manipulatives, they have state of the art Smart Boards and things like that.

Ms. Webb: Yeah, there are definitely materials in the science lab and even the kits that we got grade level school wide.

Ms. Kegley: There is so much to offer and so much equipment.

The lab consists of a variety of materials and is an immaculately kept space. It is frequently photographed and has become the main area for faculty meetings and professional development sessions. The lab instructor works with the Math and Science lead to plan the curriculum for the classes and collaborate with teachers when desired. There are many cabinets, shelves, tabletops, and other areas housing materials. Materials range in content area as well. A rock collection exists, measurement tools are available, and collections of books are within reach. There are numerous bins that contain thermometers, spring scales, rulers, manipulatives, and the like. The science lab is approximately equal to two classrooms and is only two years old. It stands in stark contrast to the age of the other buildings. In the space, there is adequate room for students to participate in lecture style lessons or utilize manipulatives in the adjacent area of lab tables. The lab also benefits from technology. A technologically advanced Smart Board is a recent addition.

Teachers can choose to participate in the planning of their classes' lessons that will be delivered within the science lab, but few do. Generally, teachers inquire only of the behavior of their students when picking their students up from their forty-minute block. Both the instructional assistant and the science lead offer themselves as help for the teachers in issues related to science. They feel that they have offered the willingness to assist, plan materials, and collaborate with teachers outside of the "specials" time. However, many teachers do not choose to receive assistance.

### *Funds for Supplies & Textbook Supplied Materials*

Teachers also responded that at times they have had access to funds to purchase materials that they would like.

Researcher: Do you think, you mentioned that you used the lab and the resources; do you feel that you are provided adequate resources to teach science?

Ms. Quillen: Yes, I do. In fact every year, the last couple of years, we've had money to buy certain things we felt we needed for the lab and the lab is set up where we have cubbies and all kinds of manipulatives are in there and it is all organized so you know exactly where to go and we have a sign out sheet so if you want something you know whether another teacher has it. So it really works very well.

Ms. Webb poses a similar thought:

A lot of my materials I have gotten by writing mini-grants. I've written the mini-grants probably for the last five or six years and have \$500 a year to spend and so that's how I've gotten a lot of my materials. Otherwise, I spend some of my own money. I'll ask for things specifically, like I know that it is coming up – like I needed to get a hot wheels race track – I was going to have the kids find how the mass of the vehicle affects speed. They were able to purchase some for me.

Teachers also commented about the materials available to them through the science textbook supplies. Textbooks are purchased for the school in each subject area but are referred to as a reference or as another tool from which teachers choose and plan their instruction. This is contrary to the district's plan where textbooks and pacing guides

determine instruction. Teachers here carry the attitude that instruction from the textbook is less favorable and not aligned with their ITI beliefs. The administration appears to support this view and encourages teachers to use the Sunshine Stand Standards to plan their instruction. In regards to the textbook supplied science kits, one teacher mentioned that they additionally had kits that were grouped by grade levels. However, the difficulty was in the utilization of these materials since grade level teams are not grouped together or are they given common planning times. Since the grade levels are divided into magnet pods a specific grade level kit would be a hodgepodge collection. You might know where some materials were located but often may not be able to locate others. When asked about immediate access to science materials, Ms. Sutton suggest that she has never been hindered by any material, noting the creation of ponds in the classroom and building a space shuttle replica outside.

### *Summary and Discussion of Findings*

Plummer and Barrow (1998) and others have reminded us that traditionally, teachers feel paralyzed to teach science because they claim they have little to no access to materials with which to teach science. At Happy Valley, a wealth of materials exists for teachers' usage and checkout. In addition, support to use the materials is also available. While teachers at the case school responded that they had access to a treasure trove of materials, observation, and anecdotal records provide a different conclusion that is contrary to the claim that a lack of materials is to blame for the failure to teach science effectively.

An abundance of science materials are available at Happy Valley but play little role in contributing to effective science teaching. Teachers, aware of their location and availability, but having other curricular goals and priorities, choose not to utilize the materials for use in their own classrooms. While an impressive science lab space exists, the space and its instruction are seen merely as an activity stop on the students' weekly wheel. For some teachers, this becomes the sole provider of science instruction for their students.

The majority of the materials are located within the confines of the science lab, often a two to five minute walk from main classroom areas. Teachers visit the lab a minimum of twice per week. Once for their "specials" time (dropping off and picking up students) and again for the weekly faculty meeting that is held in the lab. There is an informal sign out procedure and the materials are attractively arranged in bookshelves and cupboards. Two individuals who are willing and open to assist teachers in the planning of science lessons staff the lab. Additionally, science materials are scattered around the school, mostly leftover from previous science textbook adoptions that arrived with science consumable kits. As mentioned earlier teachers are aware of the materials and know the location.

Grants, the innovative appearance the school wishes to portray, and the Math and Science magnet has fueled the collection of these materials and the accompanying funds to purchase them. Yet, teachers who were interviewed rarely acknowledge their usage of the materials on a consistent basis. Two teachers acknowledge the wealth of materials but spoke of their need for an inventory sheet because it was too much trouble to plan to

use the materials without knowing ahead of time what was available. Another teacher spoke to the issue of not knowing where to get materials from teachers who possibly had checked out something she wanted to use. However, no specific instance when this had occurred was given or suggested as a problem that she had personally encountered. In truth, a small amount of materials are actually used and checked out from the lab. Teachers are content to know that the materials are there. Sadly, this does not translate into the use of the materials for science instruction as one might assume.

### Significance of Perceived Problems

The final sub question that supports the overall desire to understand how a school's culture influences science curriculum design and instruction that was asked is:

- How do the perceived problems of teachers influence effective science instruction?

#### *Problems with Science as a School Priority*

While teachers responded in language that celebrated their own science practice for its constructivist merits they were quick to comment that as a school they didn't feel that science was really a priority despite their praises regarding innovation. Many teachers commented that the collective school didn't concern itself with the topic of science:

Researcher: Do you think the school values teaching science?

Teacher: As a whole, no - for a magnet, yes - I think it is viewed a little bit on 'well, if you like science you go to that magnet' and it's like – wait a minute, how

about the Sunshine State Standards here – that is what we are supposed to be teaching to.

Conversations with science lab staff suggested that teachers leave much of the science instruction up to the lab to teach and that little science instruction would effectively be conducted in a class that lasts only forty minutes once a week. She states that, “I’ve had it stated to me exactly. I’m glad you are teaching this because we don’t do any science in our classroom.” Meanwhile, Ms. Sutton suggests that perhaps reading and math take center stage in the school, “I feel that science is kind of down at the bottom. I think it’s reading and math and if you have time, science and then if you really have time, social studies.

### *Problems with the Magnet Structure*

The majority of intermediate teachers’ perceived problems related to the magnet structure of the school and how it impacted their teaching of science. Immune from this problem were those teachers in the School of Math and Science. Intermediate teachers from other magnets felt the increased burdens to teach the “basics” and then the specific duties that pertained to their magnet. Ms. Quillen explains:

The magnet situation hurts me as a science teacher because I was in Microsociety; the focus is on social studies. So, most of what we were doing during lab time, or even instructionally needed to relate back to social studies and I could get by, by not teaching science – because I could say I was focusing on my magnet.



Overwhelmed with the demands of the day, often science was the first to go in classrooms where science wasn't the magnet focus or where science didn't relate to the classroom yearlong theme. Primary teachers also would experience the magnet limitations when they were not currently in the rotation of math and science.

Researcher: What about the magnet arrangement? You are primary. So you are magnet-less and you travel all four. How does that help with science teaching?

Teacher: I don't think it really does because when, I feel like, I am in Math and Science I do more science. When I'm in Arts and Cultures, I do more cultures. It's impossible on a day-to-day to do both science and social studies. For me anyway, I think with the magnets ... some of the science things go through the cracks because the certain magnets really won't reflect that.

This argument was also presented when teachers expressed their annoyance at the absence of students from their classrooms to participate in magnet activities. Ms. Quillen comments:

Our lab times pulled us out an hour and a half maybe two times a week. That was significant, not significantly affecting how we taught in the classroom, but, in my opinion it was our blow off time because our magnet segmented the kids by ability level practically – you have your ethnic students in low paying jobs – so I felt like we were tracking them. I just had a bad attitude about that because it bothered me that the kids that couldn't read or do math were part of the beautification crew – they were picking up trash instead of spending time academically learning how to read and write and do math.

While her comments do not specifically implicate her problems with the loss of science instructional time, some teachers who placed blame on the magnets for lost instructional time shared this general attitude. Their problem wasn't the loss of science time – but it fit the argument and was presented as a problem. Realistically, this was not a true problem for teachers as they wouldn't have necessarily used that time on science instruction if they had it back.

Some teachers expressed their disdain for the perceived favoritism of some of the magnet programs within the school. Teachers suggested that some magnets received preferential treatment and often, larger blocks of space to conduct activities in. It appeared that many teachers felt the magnets within the school were rivals.

I think that with having the four magnets – sometimes I think that – the Performing Arts area is what ... is a little more (valued). In fact, they have more of the building for their black box and the things that they do because of the “PR” and I think I would like to see it a little more evenly distributed between the four magnets.

Another agrees:

I think the Performing Arts are definitely valued more. I think because of the dancing and singing they see that more in the school. Kids going from third grade when they have to make that magnet choice – when they go on to fourth grade the majority of the kids want to go to Performing Arts because they think it is all dancing and singing and dancing around because they are the limelight of the school. They are out there.

*Problems with “Them” and “Us”*

A common theme was the disconnect between their perceived constructivist practices and what they felt the district expected of them as teachers. The teachers feel that they are “different” and that their school is likewise “different” and others do not understand the innovative practices that go on there and their value. They note a clear distinction between other schools “them” and their school “us”. Teachers commented that there is too much FCAT, too heavy an emphasis on textbooks, and even too new of a teacher to the school.

The ITI tradition and its accompanying rhetoric are strong with teachers at Happy Valley and they are critical of new teachers who are not fluent with the ITI ways as well as few older teachers who refuse to submit to the philosophy. Ms. Sutton speaks to this:

Though they say that it is and we are doing some things toward ITI, I see that we are losing some of that I’ve also seen a little more traditional type teacher here.

Teachers that might not be as committed or realizing what the magnet program is.

Another teacher agrees:

You know, you’ve been here for five years get your theme together or at least – they’re not pushing it in a mean way but, hey we need to start seeing some progress here or else maybe this isn’t the school for you and I think that’s a good thing.

### *Problems with Materials*

While the literature suggests that historically teachers feel that they don't have access to materials, this case study illustrates that even when the materials are available they are not necessarily utilized. One problem concerning the use of materials surfaced as two teachers desired an inventory and location of what was available.

Researcher: Do you think you have adequate access to resources to teach science?

Ms. Seeger: Yes and no. Yes in the fact that we have a lot of textbooks, like trade books and things like that I can find myself. But no, in regards to I'm usually not aware of what is in the building because another teacher has it in their classroom and keeps it for a year and I don't know it is in the building. That would limit my access to not knowing where it is. They are housed in other places of the building.

Ms. Kegley agrees, "I don't know what they have so I can't plan ahead to be able to teach it for the future or whatever – that's too much work." She continues:

I've never been denied being able to use something over there in the lab but I would really love to have an inventory – a list of every single thing that we can look through and even when I am preplanning I can go through the list and see what they have because sometimes it is easier to see what you can use in order to incorporate instead of trying to create something new. It's easier because it is ready to go for you.

An additional problem presented impacted those teachers who did not belong to the Math and Science magnet or who, as a primary class, weren't traveling through the school at that particular moment. One teacher expressed her displeasure in the treatment of a request for materials. As a primary teacher, her students were traveling through another part of the magnet cycle and wouldn't experience their nine weeks of Math and Science for several months. Wanting to teach a landform lesson she inquired to the lab for some consumable clay. She was denied this request and told that had she been in Math and Science at that particular time then she could have had it. The funds, they said, were just not there – but if she was currently in the magnet she could have some. Teaching science and asking for materials before her select nine weeks was hindering. She comments that she has experienced this treatment on several occasions.

A few teachers commented that they felt a certified teacher would be better served in the lab – but that it wasn't really a big deal. It was more of a problem that really wasn't problematic at all. This trend was evident when some teachers spoke of their “problems” with their specific teaching of science.

### *Summary and Discussion of Findings*

Teachers in the case study were quick to discuss their perceived problems with school issues. When responding, most teachers were equally quick to highlight the real issues they found as teachers within the structure and philosophy of the school. However, teachers responded with issues that had little to do with science and several had to be prompted to discuss their problems in the teaching of science.

At Happy Valley, perceived problems with science are not problematic to teachers in the classroom since the majority of their values and beliefs are focused towards the implementation of ITI or in their specific curricular area of interest. Additionally, strong problems are reported in regards to administration of the magnet departments and their desire to be distinctive from other public schools.

Teachers in the case study responded to a collection of general perceived problems. Teachers were eager to discuss their view of teaching non-traditionally and the problems they would experience if the school lost its innovative, ITI, thematic focus. Teachers responded strongly to suggestions that standardized testing and district pressures were not an effective fit for their “different” school. They include the:

- Disconnect between their constructivist philosophy and standardized testing
- Desire for equal magnet treatment
- Pressure to use the textbook and assessment tools from the district
- Fear of losing the ITI focus
- Fear of “traditional” type teachers and instruction
- Too many initiatives based on grant monies
- No time to share with colleagues
- Magnet curriculum demands impact classrooms

When teachers did respond to problems associated with the teaching of science, it is of the opinion of the researcher that although the problems may be seen as possible viable issues, the observation of the case school suggests otherwise. With this I suggest that perceived problems with science teaching, while spoken, are simply not real problems to

teachers in the classroom. Most often, these perceived problems were the result of inconveniences or could be attributed to the previously mentioned confines of the magnet structure. Some of the perceived problems related directly to the teaching of science. They include:

- Lab is unavailable outside of primary nine-week focus
- Too much energy to plan for inquiry-minded science
- Magnet demands keeps science on the sideline
- Magnet doesn't relate to the teaching of science
- Believe some science topics are not developmentally appropriate
- District science assessments
- Science is viewed as a bottom-rung priority from a whole school perspective
- Science fair demands not healthy for kids
- Teachers don't utilize materials to their potential
- Teachers use science lab instruction in lieu of their own classroom instruction
- No inventory of materials for easy planning
- No funds for science materials when outside of the primary magnet cycle

Of significance is the suggestion that the magnet structure is to blame for the lack of focus on science as a whole school and as specific magnet programs. While this is a valid point and continuously discussed in this research, these do not represent problems great enough for teachers to initiate any changes to their magnet assignment. Recall that teachers in the case school value the magnet topic that they teach and as a result three out of the four magnets are instructed by teachers who are

not motivated to teach science in the first place. It may be suggested that teachers in these magnets operate within the unspoken amnesty that something must be sacrificed in order to teach something else. Only when questioned about why they feel hindered in science do they suggest that the structure of the magnet program prohibits them from effectively teaching science contents. It is the opinion of the researcher that teachers are blissfully aware of their curricular freedoms that their magnet program affords them and that they are content with the treatment of science within the program boundaries.



## CHAPTER FIVE: DISCUSSION

The case study at Happy Valley Elementary Magnet School suggests that the existing school culture is organized and driven by curricular motives and subsequent day-to-day routines in areas other than effective science instruction. Therefore, the norms, values, beliefs, practices, ceremonies, rituals, traditions, use of materials, and perceived problems of all stakeholders in the school community contribute to a tenor of indifference within the school in regards to effective science instruction. Although this treatment of science is communicated in varying degrees by stakeholders within the community and the appearance of an innovative and purposeful science curriculum exists, the indicators of culture in this research (values, beliefs, practice, materials, and problems) paint a contrasting picture.

Creswell (1998) reminds us that the nature of qualitative research is an, “intricate fabric composed of minute threads, many colors, different texture, and various blends of materials” and likewise, is not explained easily or simply (pg.13). The study of the case at Happy Valley is an excellent example of an intricate school composed of many threads, colors, textures, and blends. Happy Valley exists to “do school” differently. It attempts to tackle current educational dilemmas with innovative, holistic, and brain friendly methods. It wants to see the whole child as an individual coming to learning from many possible backgrounds. One of its core philosophical beliefs is to be an innovative, constructivist, and “different” kind of school. It believes that within its design it is equipped with superior means to teach science. This research suggests that

while the school is an intricate fabric of threads, the thread of effective science instruction may find itself quite tangled.

As we begin to discuss the implications this research has encountered, it is valid to remind the reader that one goal of this research was to examine the culture of the case school and its interconnected relationships between its cultural indicators. Therefore one indicator of culture cannot be used to explain the entire school culture or its resulting problems. This has been problematic in previous literature as attempts to explain certain phenomenon is witnessed merely through one single point of view. You may recall from previous chapters, Balcaen, Boote, and Wideen's (1998) perspective that the study of culture requires the complete interconnectedness (*sui generis*) of culture indicators to explain each other. This research has elected to view these five indicators as values, beliefs, practices, materials, and problems as the basis for the theoretical framework guiding the analysis of data. Our discussion cannot place blame or responsibility for the lack of science instruction merely on materials or teacher beliefs. It is the unique interconnected nature of all the indicators that support and strengthen each indicator's merit.

### Research Questions

- How does school culture (its values, beliefs, practices, materials, and problems) influence effective science instruction?

The question was articulated and reinforced by secondary questions:

- How does the Integrated Thematic Instruction model (ITI), along with the magnet structure of the school affect the teachers' science teaching? (practice)

- How do the values and beliefs teachers express affect their science teaching?  
(values & beliefs)
- How do available materials & resources affect the teachers' science education practice? (materials)
- How do the perceived problems of teachers influence effective science instruction? (problems)

### Purpose of the Study

The purpose of the study was to describe how school culture influences effective science curriculum design and instructional practice of teachers in the elementary school setting. It aimed to better understand the nature of everyday science instruction in elementary schools and hoped to discuss and explore possible breakdowns between theory and practice. Fundamentally, this study addressed the interconnected culture indicators (its values, beliefs, practices, materials, and problems) and how those indicators supported or discouraged effective science instruction.

### Methodology & Design

This study utilized an ethnographic case study design and inquired into the perspectives of teachers in one elementary school about their values, beliefs, practices, materials, and problems in the teaching of science. The data was addressed in light of the theoretical framework and triangulated from semi-structured participant interviews, researcher's observation, and artifact/document collection.

## Findings

I present in the previous chapter findings that address the core research question. Those findings suggest that the school culture at Happy Valley Elementary Magnet School is organized and driven by curricular motives and subsequent day-to-day routines in areas other than effective science instruction. Therefore, the norms, values, beliefs, practices, ceremonies, rituals, traditions, use of materials, and perceived problems of all stakeholders in the school community contribute to a tenor of indifference within the school in regards to effective science instruction. Although, this treatment of science is communicated in varying degrees by stakeholders within the community and the appearance of an innovative and purposeful science curriculum exists, the indicators of culture in this research (values, beliefs, practice, materials, and problems) paint a contrasting picture.

Likewise, I present in the previous chapter several assertions that can be drawn from the sub-research question of this research. Those assertions include:

- The appearance of constructivist actions and the guise of innovation provided by the ITI model and the magnet structure give stakeholders within the school community confidence that they are consistently delivering high-quality education through innovative and constructivist means. While the school is successful in areas such as reading and mathematics, the appearance of innovation and science-like activities, are routinely substituted as effective science instruction at Happy Valley.

- The curricular freedoms within the magnet structure allow for the individual values and beliefs of the teacher to set the tone for the content and instruction that it delivered there. Teachers are encouraged to develop curriculum that complements their selected magnet and meet the innovation ideals of the collective school community. Since three of the four magnets are non-science related this contributes to the disregard for effective science teaching and may also allow for the complete amnesty of science instruction.
- An abundance of science materials are available at Happy Valley but play little role in contributing to effective science teaching. Teachers, aware of their location and availability but having other curricular goals and priorities, choose not to utilize the materials in their own classrooms. While an impressive science lab space exists, the space and its instruction are seen merely as an activity stop on the students' weekly wheel. For some teachers, this becomes the sole provider of science instruction for their students.
- At Happy Valley, perceived problems with science are not problematic to teachers in the classroom since the majority of their values and beliefs are focused towards the implementation of ITI or in their specific curricular area of interest. Additionally, strong problems are reported in regards to administration of the magnet departments and their desire to be distinctive from other public schools.

These assertions cannot stand alone as the individual reasons for how factors of school culture individually impact science curriculum design. We must again, rely on the

interconnected picture these four assertions paint as to how Happy Valley's school culture shapes, molds, and exercises its influence on teachers as they design and deliver science instruction.

### Findings that Support the Literature

Although many teachers are aware of the rhetoric surrounding science education, many still remain unconvinced that science deserves a place in the elementary school (Fensham, 1992). Payne (2004) notes, that teachers and stakeholders continue to place science as a second tier subject. This research suggests that the case school treats science no differently. I do not propose that we hold Happy Valley more accountable than any other elementary school with everyday elementary teachers in regards to their treatment of science.

Although it attempts to be different, in many ways Happy Valley carries the same curricular baggage that traditional schools do. If we acknowledge that science is absent from many traditional elementary schools then this research has allowed us to further conclude that alternative structures like magnet schools may contribute little in the promises they make for superior science instruction in the elementary school. Although they offer many other worthwhile goals, science curriculum design and instruction is often treated in accord with the everyday traditional school from which they wish to separate themselves from. I also venture to suggest that in this scenario, science instruction may very well be additionally sacrificed for the design of the school with the teaching of science being less effective than at the typical elementary school.

Giles and Hargreaves (2006) suggest in their research that innovative schools are quick to receive recognition in the short term for promoting new ideas in regards to teaching and learning. However, in the long term, many schools carry what they see as a “well documented tendency to fade after an initial golden age.” Schools often rejoin with mainstream schools and begin to look again like any other school (Giles & Hargreaves, 2006; Dormeus, 1981). Drawing many of their conclusions from the work of Fink (2000), Giles & Hargreaves (2006) offer the idea that innovative schools possess a predictable, evolutionary life span. Further, forces within the school such as leadership changes, loss of key faculty, district goals, student body changes, parental support, and often teachers’ own “traditional inclinations” will draw the “school’s center of gravity back towards the conventional grammar of schooling” (pg.125).

The magnet structure of the school influences the teaching of science greatly at Happy Valley. Unless teachers were members of the School of Math and Science, their science instructional practice was limited and when it did exist, was superficial. Consider the idea that a teacher’s tendency to prefer subject areas other than science is well documented. Previous bad experiences, lack of content knowledge, and low confidence to teach science already existed for many teachers (Appleton, 2006). Couple this with a school environment that affords them the opportunity to excel in other content areas (other than science) exclusively and the notion that teachers are going to teach science any differently is foolhardy.

While behind closed doors we are somewhat unaware of its treatment; on paper, American teachers have previously responded that they spent an average of 25 minutes

per day in the study of science (Fulp, 2002). Other estimates place it at a mere 14.7 minutes per day (Finson & Linsowski, 1996). Science at Happy Valley is sporadic at best, with only 40 weekly minutes of science being guaranteed and delivered by the science lab instructor while teachers leave for their planning periods. For students in the Math & Science magnet, the outlook is substantially improved.

This research confirms what the current body of literature already details regarding teacher avoidance and dislike for the teaching of science (Appleton, 2006). For those that attempt to teach some science, teachers typically “cope” with instruction centered on a small collection of activities (Appleton & Kindt, 1999). The casual observer will find similar core “science coping activities” on the campus of Happy Valley. Teachers routinely suggested token science activities for science instruction (aquariums, large scale space shuttles, racing experiments, terrariums, etc). Another view in the literature, that this research also suggests is that teachers are fundamentally content with the status quo and do not desire for science to be improved or even taught in their classrooms (Fensham, 1992). This suggestion again reminds us that what we teach is directly related to the values and beliefs that we hold about education.

This research also confirms the notion of the large discrepancy between teacher beliefs and classroom practice (King, Shumow, and Lietz, 2001). Previous literature illustrated the gap between what teachers said that they were doing and what they found to be occurring in their classrooms. Happy Valley’s teachers, while well intentioned, frequently cite an inflated view of the science practice and practice it differently within their classrooms. This research also confirms the current body of literature regarding



the “buzzwords” used in science education discussion. Teachers in the study were aware and had active vocabularies for constructivist science words. The term, “hands on” being the most misused word in the study. Previous studies also suggest that teachers have a limited understanding of the scientific vocabularies that they use (King, Shumow, and Lietz, 2001; Bybee, Ferrini-Mundy, and Loucks-Horsley, 1997). Teachers historically carry the notion that their science instructional practices are satisfactory (Kagan, 1992, Grossman, Wilson, and Shulman, 1989). Fine (1991) reminds us that teachers look for ways to explain their efforts and feel good about the jobs that they have done, even at the cost of inflating the effectiveness of what they’ve done. While this may help teachers at Happy Valley feel better about themselves and their teaching, this viewpoint can hinder them from being able to see the need for possible change.

#### Findings that Contribute to the Literature

The principal contribution of this study to the literature is the examination of effective science instruction through the lens of interconnected and interrelated cultural forces. This theoretical framework emphasizes that school culture cannot be reduced to beliefs, values, practices, materials or problems, but rather, each aspect of culture is interdependent and mutually reinforcing. Previous culture studies fail to see the implications of this suggestion. Gill and Boote (2006) suggest that the failure to see the *sui generis* nature of culture is the great weakness of much of the current “culture talk” in educational research and that by only examining how these indicators of culture reinforce each other can we truly see their interrelatedness.

An additional contribution is that of innovation. Happy Valley experienced its golden age in the 1990s and was even highlighted in an educational publication for its innovativeness. This research suggest that at present, the appearance of constructivist actions and the guise of innovation provided by the ITI model and the magnet structure may detract from the teaching of science at Happy Valley. This research adds to the body of literature in regards to the use of the Integrated Thematic Instruction reform model and its impact on science. The Comprehensive School Reform Quality Center (2005) published its November 2005 report on the nation's top reform programs and their respective effectiveness. The model, Integrated Thematic Instruction (ITI), is one of those reviewed. In their review, the program required the expenditure of over \$200,000 during the course of the initial three-year implementation. In regards to student achievement, the report noted "limited" effects of the program overall and "limited" effects of the program in the area of reading. In the areas of science and mathematics, the program is rated "zero" in its impact on student achievement in these areas (no significant increases in scores). Happy Valley's claim that the ITI program provides superior science instruction is not supported in achievement or, as a result of this study, in classroom action or teacher behavior.

What the current body of literature fails to contain is the qualitative impacts of the program on the school. This research suggests that the ITI program may provide the stage for the appearance of constructivist rhetoric in the area of science that is sufficient enough for teachers to believe their science instruction is being effective. This again suggests that teachers typically misrepresent their beliefs and what is actually occurring

in classroom practice (King, Shumow, and Lietz, 1999). Van Driel, Beijaard, and Verloop (2001) found similar implications when teachers had difficulty transforming their wholehearted beliefs about innovation into actual practice. Additionally, this research adds to the body of literature in highlighting how a teacher believes her ITI instruction to be and how she may only practice a small surface level integration of it.

Lack of materials or funds to purchase materials is often cited in the literature as a common deterrent from teaching science (Finson & Lisowski, 1996; Ruby 2006). A review of K-6 schools in Illinois found that materials and supplies were available to only 41.8% of teachers. Equipment was also absent from many classrooms (60.5%) and when it was found was often old and in disrepair (Finson & Lisowski, 1996).

This research adds to the body of research in that, few studies comment on the teaching of science in spite of the abundance of materials. Ruby (2006) suggests a slight notion that when materials are available teachers may sort through them choosing specific items for use in science. However, this research suggests that even with an abundance of materials science is not taught and teachers make few motions to use the available materials. This research suggests that the interconnected nature of values, beliefs, practice, materials, and problems is the only way to address how having materials makes no impact on teachers at the case school.

### Suggestions for Future Research

This research offers many avenues for further exploration. An initial suggestion for future research is to examine how school culture influences science teaching when the school as a whole is attempting to change its science practice. Knowing how teachers

react to change that is forced upon them may further highlight the role of school culture in effective science teaching.

Having participated in the school culture as a teacher, I am interested in understanding how the magnet program and the structure of the intermediate grades impact the general academic teaching in the school. Teachers suggested that the magnet program drove the curriculum from day-to-day and often away from academic avenues. Future research might examine how the magnet structure influences instruction in reading, mathematics, and social studies. Specifically, research into the effectiveness of the program for minority populations that attend the school is warranted in light of the history of federal consent decrees that prompted the development of the magnet school.

I also see great need for future research in the effectiveness of costly reform programs such as the Integrated Thematic Instruction (ITI) model and expressly, Comprehensive School Reform Grants as a whole. While it sets a certain environmental and climatic tone for the school, it appears that teachers spend more time creating themes and themed environments than planning for quality instruction, be it integrated or not. Future research might also examine the nature of impact of the ITI program when implemented at a low surface level versus a deeper level. Limited literature gives no indication as to the level of involvement teachers have with the program. How are we to know if the results reported in an ITI study are based on Level 1 implementation of the model (surface and climate) or Level 2 (curricular)?

Finally, I would suggest that the implications of a self-contained science lab (and the staffing of a certified teacher or an instructional assistant) at the elementary school

level be explored. It appears in this research that the presence of a science lab allows teachers to separate themselves even more from the teaching of science. Science merely takes the shape of other specials taught exclusively away from the general education of the classroom such as art or music. While it is a tremendous space to conduct quality science lessons is it doing more harm than good as a weekly visit on the student's specials wheel?

### Relationship to Bracketing Exercise

As I look back and examine my bracketing exercise that was completed prior to the start of this study (Appendix E) I note several findings that parallel my personal experiences at Happy Valley. To begin, I initially encountered the magnet structure of the school being my biggest challenge as a young teacher. For teachers placed in the appropriate magnet that was tailored to their personal interests the payoff was favorable. As a new teacher, and not necessarily devoted to my magnet assignment, this became a large burden. The stress of attempting to cover large amounts of content was challenging enough even without the curricular goals of the magnet. I found myself participating in the science-like, coping, activities that appeared innovative and fun. In earnest and like many key informants in this study, science was the first subject to go when trying to fit all the elements of a busy day together, another parallel to this research. I relied heavily on the science textbook but felt that it wasn't an accepted practice in the ITI environment. This element was also suggested by key informants of the study.

I also encountered major findings that went beyond my beliefs I detailed in my bracketing exercise. As a participant of the school, I was ignorant and unaware, but

deeply consumed in my use of buzzwords and constructivist languages. Following my colleagues, I too assumed what I was doing was in the ultimate best interest of children, was “different,” and the pursuit of innovative activities for my students trumped deep curricular planning for my students. I was not fully aware of this until the evolution of this study and my eventual departure from the school that provided me a different vantage point to see what occurred there. As a result of this research I am also able to understand and acknowledge how the imbedded aspects of school culture so quickly molded me into a true Happy Valley teacher. My learning about the interconnected relationship of school culture has impacted my interpretation of how to address change from a district perspective which my current position requires of me.

### Conclusion

This ethnographic case study of Happy Valley investigated the science practices of one elementary school in light of how school culture influences integrated science curriculum design and instruction. The purpose of the study was to address how school culture (the sum of its values, beliefs, practices, materials, and problems) impacted the treatment of science as a viable content area. Key informant teachers were interviewed to uncover their values, beliefs, practices, materials, and problems with science instruction. Researcher observation and artifact/documents were collected in an effort to triangulate data.

Findings at Happy Valley Elementary Magnet School suggested that the existing school culture is organized and driven by curricular motives and subsequent day-to-day routines in areas other than effective science instruction. Therefore, the norms, values,

beliefs, practices, ceremonies, rituals, traditions, use of materials, and perceived problems of all stakeholders in the school community contribute to a tenor of indifference within the school in regards to effective science instruction. Implications of innovation, instructional methods, use of materials, and perceived problems were also addressed.

This study confirms the body of research that claims that science is rarely taught by most teachers and rarely taught well when it is. Happy Valley's magnet structure certainly impacted this. While the teachers knew the rhetoric of effective science education and value it enough to not dismiss it entirely, most value it less than other subjects. This study builds upon the literature by reiterating that school culture plays a central role in elementary science education, but adds to that literature by emphasizing that culture cannot be reduced to one or a few factors and must be seen as an organic whole.

APPENDIX A  
IRB APPROVAL





Office of Research & Commercialization

December 19, 2005

Lori T. Meier  
4813 Buttonwood Drive  
Melbourne, FL 32940

Dear Ms. Meier:

With reference to your protocol #05-3102 entitled, "**The Culture of Science Curriculum Design & Instruction in the Elementary School Setting**," I am enclosing for your records the approved, expedited document of the UCFIRB Form you had submitted to our office. **This study was approved on 12/14/05. The expiration date will be 12/13/06.** Should there be a need to extend this study, a Continuing Review form must be submitted to the IRB Office for review by the Chairman or full IRB at least one month prior to the expiration date. This is the responsibility of the investigator. **Please notify the IRB office when you have completed this research study.**

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 through use of the Addendum/Modification Request form. Changes should not be initiated until written IRB approval is received. Adverse events should be reported to the IRB as they occur.

Should you have any questions, please do not hesitate to call me at 407-823-2901.

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

Cordially,

*Barbara Ward*

Barbara Ward, CIM  
UCF IRB Coordinator  
(FWA00000351, IRB00001138)

Copies: IRB File  
David Boote, Ph.D.

BW;jm



THE UNIVERSITY OF CENTRAL FLORIDA  
INSTITUTIONAL REVIEW BOARD (IRB)

*IRB Committee Approval Form*

PRINCIPAL INVESTIGATOR(S): **Lori T. Meier** IRB #: **05-3102**  
(Supervisor: **David N. Boote, Ph.D.**)

PROJECT TITLE: **The Culture of Science Curriculum Design & Instruction in the Elementary School Setting**

- New project submission
- Continuing review of lapsed project # \_\_\_\_\_
- Study expires
- Initial submission was approved by full board review, but continuing review can be expedited
- Suspension of enrollment email sent to PI, entered on spreadsheet, administration notified \_\_\_\_\_
- Resubmission of lapsed project # \_\_\_\_\_
- Continuing review of # \_\_\_\_\_
- Initial submission was approved by expedited review

**Chair**

Expedited Approval

Dated: Dec. 14, 2005  
Cite how qualifies for expedited review: minimal risk and #7

Exempt

Dated: \_\_\_\_\_  
Cite how qualifies for exempt status: minimal risk and \_\_\_\_\_

Expiration  
Date: Dec. 13, 2006

**IRB Reviewers:**

Signed: [Signature]  
Dr. Sophia Dziegielewski, Vice-Chair

Signed: \_\_\_\_\_  
Dr. Jacqueline Byers, Chair

Signed: \_\_\_\_\_  
Dr. Tracy Dietz, Designated Reviewer

**Complete reverse side of expedited or exempt form**

- Waiver of documentation of consent approved
- Waiver of consent approved
- Waiver of HIPAA Authorization approved

NOTES FROM IRB CHAIR (IF APPLICABLE):

First review, see attached comments. [Signature] 12/13/2005

APPENDIX B  
DISTRICT CONSENT



## Office of Accountability, Testing, and Evaluation

To: Lori Meier

From: Karen Schafer  
Office of Accountability, Testing, & Evaluation  
Brevard Public Schools

Subject: Acceptance of Application to Conduct Research

Date: 11/15/2005

Dear Ms. Meier:

Thank you for your application to conduct research in the Brevard Public Schools. This letter is official verification that your application has been accepted and approved through the Office of Accountability, Testing, & Evaluation.

This is a reminder that you must contact the principal(s) of the school(s) listed on your application, present them with copies of your Application Form, and secure their signatures for approval. Approval of your study at the district level does not obligate principals to participate in the proposed research.

In the future if you have any questions or concerns, please contact Karen Schafer at 321/633-1000 extension 328. Good luck and please submit your research findings and summary to:

Office of Accountability, Testing, & Evaluation  
Research Results  
Brevard Public Schools  
2700 Judge Fran Jamieson Way  
Viera, Florida 32940

APPENDIX C  
INFORMED CONSENT

## INFORMED CONSENT

December 1, 2005

Dear Educator:

I am a doctoral student completing my dissertation under the supervision of Dr. David Boote at the University of Central Florida in the College of Education. You are being asked, as a teacher or administrator, to participate in a study designed to gather information on how school culture influences science curriculum and science instruction. This research project was designed solely for research purposes, not as an evaluation of you or the school. If you agree to participate, you may be asked to participate in one or more interviews, totaling two hours of time, and an informal classroom observation (if applicable). No one, except the researcher and Dr. Boote will have access to any of your responses. All responses and your identity will be kept confidential. You will not have to answer any question you do not wish to answer.

With your permission, I would like to audio record the interview portion of the study. Only I and Dr. Boote will have access to the recording, which I will personally transcribe, removing any identifiers during transcription. When no longer needed, the recording will be erased. Any identifiable interview information will be assigned to your pseudonym with any non-essential identifiable information (i.e. grade level) altered to protect you, the participant. Your identity and identifiable information will be kept confidential and will not be revealed in the final manuscript.

Although free from anticipated physical risks there are some inherent risks of this type of qualitative design that can perhaps, place you, the participant, in a vulnerable position. For example, as you discuss and evaluate your own personal teaching practices, you might feel uneasy expressing your authentic thinking and attitudes towards the subject of science or anxious that your thoughts and responses will be available to colleagues and/or other administrators. It is the responsibility of the researcher to ensure confidentiality and provide a professional, non-intrusive, manner to the data collection and its presentation. Several steps will be taken to ensure your confidentiality and privacy. All participants will be assigned pseudonyms to protect their individual identities. Only the researcher will have access to the list that links the participant name to their pseudonym. This list will remain under lock and key, as well as all documentation, written notes, and observations that could further link you to your identifiable information (room description, grade level, etc). At the conclusion of the study, the list of participants will be destroyed. If needed, within the final writing and discussions of the study identifiable situations and contexts will be altered to ensure the confidentiality of the participant while maintaining the integrity of the issue.

There is no compensation or other direct benefits to you as a participant in this study. Your participation in this project is voluntary. It is estimated to take approximately 2 hours your time, collectively, over the course of six weeks. You are free to withdraw your consent to participate and may discontinue your participation in the research at any time without consequence. The findings of this research will be collected and reported in the final dissertation manuscript and publications.

If you have any questions about this research project, please contact me at (321) 254-3477 or my faculty supervisor at (407) 823-4160. Questions or concerns about research participants' rights

may be directed to the UCFIRB office, located at the University of Central Florida Office of Research, Orlando Tech Center, 12443 Research Parkway, Suite 207, Orlando, FL 32826. The phone number is (407) 823-2901.

Sincerely,

Lori T. Meier

\_\_\_\_\_ I have read the procedure described above.

\_\_\_\_\_ I voluntarily agree to participate in the procedure and I have received a copy of this description.

\_\_\_\_\_ I voluntarily agree that the researcher may contact me for an interview.

\_\_\_\_\_ I voluntarily agree to be audio recorded.

---

Participant Signature

Date

---

Principal Investigator's Signature

Date

APPENDIX D  
TEACHER INTERVIEW PROTOCOL



APPENDIX D

TEACHER INTERVIEW PROTOCOL

Question	Probes	Desired Information
<p>1. Please tell me about your teaching background.</p>	<p>a) How long have you been teaching?</p> <p>b) What type of college training did you have?</p> <p>c) Have you taught at other schools?</p> <p>d) How was science taught at your other schools?</p>	<p>Teacher background and previous experiences at Happy Valley and other schools.</p>
<p>2. Please tell me about your science teaching.</p>	<p>a) How do you decide how often and how long your instruction will be?</p> <p>b) What materials do you incorporate?</p> <p>c) How do you know that students have learned the material you have set out to teach?</p> <p>d) Do you feel you have adequate access to resources to help you teach science?</p> <p>e) Do you plan to teach science with other content areas?</p> <p>f) How do you feel about “hands-on” science lessons?</p> <p>g) How does the ITI curriculum format affect your teaching?</p>	<p>What the teacher encounters and initiates on a daily basis. What the teacher believes is being taught, assessment methods, and instructional practice. Teacher’s perceived thoughts regarding materials, curriculum design, and the ITI school program.</p>
<p>3. How does working at Happy Valley impact your teaching of science?</p>	<p>a) How? What aspect of your teaching was enhanced?</p> <p>b) Did it lead to enhanced student achievement?</p>	

	<p>c) How has the magnet arrangement enhanced your instruction?</p> <p>d) What aspect of your teaching was detracted from?</p> <p>e) How has the magnet arrangement detracted from your instruction?</p> <p>f) What does the school value?</p> <p>g) Are there policies that affect your teaching?</p> <p>h) What about parent support?</p>	<p>Teacher's perceived thoughts regarding support of administration, school magnet setup, school values, school policy, and parental support.</p>
<p>4. Ask for statement clarification, addition, or deletions from interviewee.</p>		<p>Verification of researcher interpretation</p>

APPENDIX E  
RESEARCHER BRACKETING EXERCISE

## RESEARCHER PERSONAL BIAS BRACKETING EXERCISE

As is appropriate for qualitative case study research, the researcher must examine and indicate personal bias when looking at the research in question. As Creswell (1998) suggests, personal bracketing exercises allow the researcher to understand his or her preconceived ideas about the research questions and the cultural group. As a teacher in the study school for four years I had personal experiences with the study participants, the school structure, and the teaching of science there.

### Pre-service & Early Teaching Background

I had graduated with a Bachelor's degree in English from a small liberal arts college in Tennessee in 1999. At the time, I had almost six years invested in the degree – having floated from major to major – and by way of West Virginia University and Ohio State University. I felt time was of the essence upon graduating at the age of 24. I often felt that I did not form any personal or academic interests until about 21. Once those academic interests started to take shape, albeit extremely varied and diverse, I found myself in a perplexing situation. Consequently, I would take assorted classes and “fall in love” with the content presented. Thanks to quirky, interested, and supportive professors I was sure, at one time, that I would be the next great geographer (thanks to a geography course) and the next great geologist (again, thanks to a phenomenal geology course). While the interest remained, the idea of pursuing those fields in light of declaring a “major” I grew disinterested and would turn to the next interest/career idea. I knew I

valued education and academia, my own father having earned a doctoral degree in religious ministry. Graduate school was always in the plan – the content - that was flexible.

After graduating with my bachelor’s degree in English, a timely and easily maintained choice, I immediately began to seek out graduate attendance at the local state university. I enrolled in an 18 month intensive Master’s of Arts in Teaching degree that provided K-8 specialization as well as initial licensure. At the time, I felt that my varied content related interests would serve me well as a teacher. I certainly entered the field hoping and banking for an intellectually engaging daily routine “somewhat” aware that the clientele would be children. It was a rewarding experience – but I doubt very different from any other pre-service educational program in the United States. I had methods courses in the main subject areas and served a semester in fulltime student teaching. I experienced my science methods courses as a collection of inquiry based classroom experiments – meant to equip us with a standards-based view of teaching science, the scientific process, and a repertoire of intermediate-level first year teaching activities. Looking back, I recall very few of the experiences.

### The First Year in Florida

I taught for six months in the state of Tennessee before making the move to Florida. Once in Florida, I immediately was hired for a performing arts sixth grade position at the subject school. I felt that I was hired for my background knowledge of ITI, the school reform model, and the fact that the school year would begin in three

weeks. I also had a background in the performing arts having spent three years performing at the local community college – a fact, that I would soon realize most likely truly landed me that first job. I began that July in what was essentially my first year of teaching. I was terrified. I found the arrangement of the school interesting and “out of the box.” Little did I know that I was walking into a position that carried with it high parent anticipation and established expectations in regard to the performing arts side of the curriculum. I found the Performing Arts magnet to be very active, highly visible, and at times, exhausting. Immediately, I felt the pressure to please both parents and students with a performance centered classroom (lots of signing, dancing, and acting) – that also happened to do a satisfactory job at integrating reading, math, science, and social studies as required in the ITI curriculum. One value of the magnet became very clear as students were regularly pulled from my classroom for other performance related rehearsals. Had I been a stronger, more mature teacher I would have questioned the practice – but being a first year teacher clinging to the hope of being accepted – I remained quiet. I found the social classroom community also to be challenging. The student community had looped as a group from grade four to grade six. By the third year, tensions between students could run high. The mix of adolescent life and three years of an established social pecking order made teaching even more challenging. Over the next four years I did establish a more academic environment, not without parental critique, but nevertheless things were certainly more manageable.

### Experiences with Science

With the expectation to teach basic skills and the performing arts it was obvious to me that science instruction in my classroom would suffer. It did, and I knew it did – but according to the values that I perceived were presented in the school and in my small community of the School of Performing Arts – I felt I was released from that responsibility. I assumed that you traded off the exemplary for the mediocre in order to attune to another idea. There was superficial coverage of the science textbook, sections chosen that I felt comfortable and fairly knowledgeable with. By the third year, I had invited another teacher to my room to conduct a science lesson and I created some simple inquiry based experiments that allowed my students to experiment with some resemblance to the scientific process. I stuck with the content I was most interested and proficient in: geological sciences, earth & space, and weather. My students participated in the once weekly, 45-minute, science lab time that served as my planning period. Occasionally, I would utilize the materials available in the science lab and transport them to my classroom. Professional development opportunities in the area of science were limited and I remember having attended only one, one-day, session over the course of four years with a speaker who could use high interest science experiments in order to launch deeper discussions. I remember having great science for about a week after that. While I was struggling to do a better job, I do feel that I did an inadequate job of teaching science during my time at the subject school. At the end of my fourth year at the school I was offered a position at the district office providing professional development in the area of literacy to teachers in Title I schools.

### Themes and Assumption from My Experience

Looking back over my time at the subject school several constant themes emerged about my experiences there. They include:

- The magnet structure of the school proved to be my biggest challenge.
- Science was the first to go when trying to fit all the elements of a busy day together.
- I relied heavily on the science textbook but yet felt that it wasn't an accepted practice in the ITI environment.
- My personal belief and value systems about the purposes and priorities that occur in a school setting were very different than many in my school environment and the school model.

First, I believed the magnet structure of the school was my biggest challenge. I was very interested in providing my students with academically engaging content coverage. I also wanted to focus on thinking skills and critical literary analysis in my classroom. Consistently, I felt annoyed that parents would call only to discuss how "Suzie" would have or – most likely – did not land the lead character in the play I was obligated to provide. I did try to choose performance ideas that were at least loosely content related (Colonial America, Pearl Harbor, etc). The plays and performances were accepted and even applauded. From a history perspective, students left my class sufficiently equipped.



A second theme was also clear; science was the first to go when trying to fit all the elements of a busy day together. Again, it was common practice for students to be removed from my classroom for assorted performance rehearsals that involved all fourth through sixth grade students in the magnet. It would be a grumble I would encounter often. It was often all we could do to cover reading, writing, math, and rehearsal times within the day. When I could plan for some time, I attempted to at least once a week, I would have a science block.

A third theme emerged early; as I relied heavily on the textbook but yet felt that it wasn't an accepted practice in the ITI environment. For me at least, using the textbook allowed me to feel that I had done a satisfactory job. A final theme that emerged from my experiences that has been, perhaps, the hardest to take. My personal belief and value systems about the purposes and priorities that occur in a school setting were very different than many in my school environment and the school model. This amounted to much confusion and wandering as I tried to reconcile my role in the education field and certainly, was a factor in my desire to continue graduate studies and pursue a doctoral degree. I am aware that I am critical of schools and their intents. I also found myself to question the reform model of the chosen school, ITI.

It is with great awareness and care that I continue this research aware of my own experiences and biases that this bracketing exercise has allowed. Having been away from the school site (and freed from the personal stressors) has allowed me to be more impartial in my evaluation of how science curriculum design and instruction occur in the elementary school

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