WHAT GOAL IS OF MOST WORTH? THE EFFECTS OF THE IMPLEMENTATION OF THE TEXAS ASSESSMENT OF KNOWLEDGE AND SKILLS ON ELEMENTARY SCIENCE TEACHING

A Dissertation

by

PAMELA ENGLAND RODGERS

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2006

Major Subject: Curriculum and Instruction

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ABSTRACT

What Goal Is of Most Worth? The Effects of the Implementation of the Texas Assessment of Knowledge and Skills on Elementary Science Teaching. (May 2006)

Pamela England Rodgers, B.S.Ed., Missouri Southern State College;

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Chair of Advisory Committee: Dr. Lynn M. Burlbaw

This qualitative, narrative study centered on the effects of the implementation of the science portion of the fifth grade Texas Assessment of Knowledge and Skills (TAKS) on the instruction of science at the elementary level, grades one through five. Fourteen teachers and five administrators were interviewed at two elementary schools (kindergarten through grade four) and one middle school (grades five and six). Classroom observations of each of the teachers were also conducted.

The study focused on the effect of the implementation of the science TAKS on the amount of time spent on science as well as the instructional methods utilized in the elementary science classroom. Lower grade levels were found to have changed little in these areas unless strong administrative leadership – emphasizing curriculum alignment, providing adequate materials and facilities, and encouraging sustained, content-based professional development in science - was present in the school. At the fifth grade level, however, the amount of time spent on science had increased significantly, although the instructional methods utilized by the teachers were focused more often upon increasing ratings on the test rather than providing the research-based best practice methods of

hands-on, inquiry-based science instruction. In addition, the study also explored the teachers' and administrators' perceptions of the state and local mandates concerning science instruction and preparation for the TAKS.

Other topics that came to light during the course of the study included the teachers' views on accountability and the effects of the state assessments on children in their classrooms. It was found that most teachers readily accept accountability for themselves, but are opposed to one-shot high-stakes tests which they feel are damaging for their students emotionally and academically – adversely affecting their love of learning science.

DEDICATION

For my parents, Phil and Yvonne England

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I would like to thank my committee chair, Dr. Lynn M. Burlbaw, for his guidance and support throughout my doctoral studies. I would also like to thank my committee members: Dr. Kris Sloan, for his encouragement when I initially chose my dissertation topic; Dr. Vickie Williamson, for encouraging my continuing interest in inquiry methods of science instruction; and Dr. Janie Schielack, for her work with the Information and Technology in Science (ITS) institute at Texas A & M, without which I would have never been able to continue my doctoral program.

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I thank my fiancé, Eric, for his constant support: baby-sitting my younger daughter, ignoring my bad moods, encouraging me when I needed it, and all of the other little things he did to make my life less stressful!

I also thank my sister and brother-in-law, Karen and James. Thank you, Karen, for letting me bounce ideas off of you and for proof-reading all of those papers (and for not being too mad when we were kids and I wanted to read all of the time instead of play outside!). I'm so proud of everything you've accomplished in your life. You are the

best sister in the world!

I thank my grandparents, Drew and Beulah Basham and Herman and Mildred England. Although I no longer have their physical presence here on earth, their moral and spiritual legacy continues to guide me.

A *huge* thank you goes to my daughters, Kessley and Kaitlyn, for never letting me quit, for cheerfully eating fast food (almost exclusively these past few months!), for ignoring my bad moods when I was tired and everyone forgot that I Knew Everything and was the Best Mom in the World, and for making me so proud of them absolutely every single day.

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CHAPTER I

INTRODUCTION

For the past several years, the need for quality elementary science instruction has been well-documented (Ehlers, 2002; Eick, 2003; Haury, 2003; Lopez & Tuomi, 1995; National Research Council, 1996; Peterson, 2002), as has the need for an increase in the amount of time allocated for science instruction (Cole, 2001; Harlen, 1992; McNeil, 2000b; Plourde, 2002). In the past, instruction in science has tended to suffer at the elementary level, with math and reading receiving the greater emphasis (Beiswenger, Stepans, and McClurg, 1998; Dickenson, Burns, Hagen, & Locker, 1997; Jorgenson and Vanosdall, 2002; Van Horn, 1995). Several studies have attributed this problem to the fact that science had not been introduced to the "high-stakes testing" trend (Ediger, 2001; Olson, 2002, 2003; Shepard, 2000).

However, the recent implementation of the fifth-grade science portion of the Texas Assessment of Knowledge and Skills (TAKS) has, for the first time, placed elementary science education on a standardized testing level previously dominated by reading and math. In a 1999 survey which explored elementary teachers' views on science education, a majority of Texas elementary teachers (grades one through five) assumed that the advent of the fifth-grade science TAKS would improve conditions in elementary science education, specifically by increasing the amount of time spent on science and by increasing the materials available for science due to its greater emphasis at the elementary school level (McNamara, Stuessy, McNamara, & Quenk, 1999).

This dissertation follows the style of *Education and Urban Society.*

The Problem

The problem centers on the lack of research regarding the current status of science education at the elementary level since the implementation of the fifth grade science TAKS.

Therefore, the purpose of this study was twofold: 1) to determine the current state of science instruction at the elementary school level and how it has been affected by implementation of the science TAKS, and 2) to determine the teachers' and administrators' perceptions of state and local mandates resulting from the implementation of the fifth grade science TAKS.

Research Questions

The central questions to be considered in this study are:

1. Has the implementation of the fifth grade science TAKS affected the amount of time allocated to science instruction at the elementary school (1-5) level? If so, how?
2. Has the implementation of the fifth grade science TAKS affected classroom instructional strategies in science at the elementary school (1-5) level? If so, how?
3. What are the state and local mandates concerning science instruction and preparation for the TAKS as perceived by the teachers and administrators?
4. What is the current status of elementary science education reported by teachers, both in time allotted for science as well as in instructional methodology?

Definitions

The following terms will be used at various points in this study:

Academic Excellence Indicator System (AEIS) - used by the Texas Education Agency to provide information about districts and schools across the state; includes demographic information, passing rates for the Texas Assessment of Academic Skills, etc. The campus and district ratings under this system consist of Exemplary (the highest rating), Recommended, Academically Acceptable, and Academically Unacceptable (the lowest rating). Table 1, shown below, gives the standards required for each of these ratings:

TABLE 1
2006 AEIS Ratings Standards

TAKS Indicator	**Acceptable (Percent Passing)**	**Recognized (Percent Passing)**	**Exemplary (Percent Passing)**
Reading / ELA	60%	70%	90%
Writing	60%	70%	90%
Social Studies	60%	70%	90%
Mathematics	40%	70%	90%
Science	35%	70%	90%

SOURCE: Texas Education Agency (2005)

Building Leadership Team (BLT) – a committee comprised of selected teachers, parents, and administrators from a single campus; sets goals and makes suggestions and decisions concerning that particular school

District Leadership Team (DLT) – a committee comprised of selected teachers, parents, and administrators from schools throughout the district; primarily responsible for setting the school calendar and developing the district improvement plan each year, as well as making suggestions that concern the district as a whole

English Language Learners (ELL) – students whose first language is not English and who are in the process of learning English (Texas Education Agency, 2005)

Gifted and Talented (GT) – a child who performs at or shows the potential for performing at a remarkably high level of accomplishment when compared to others of the same age, experience, or environment (Texas Education Agency, 2005)

Texas Assessment of Knowledge and Skills (TAKS) - a comprehensive testing program for public school students in grades 3-11; designed to measure to what extent a student has learned, understood, and is able to apply the important concepts and skills expected at each tested grade level (Texas Education Agency, 2005)

Texas Essential Knowledge and Skills (TEKS) - the state-mandated curriculum for Texas public school students; essential knowledge and skills taught at each grade build upon the material learned in previous grades (Texas Education Agency, 2005)

Assumptions, Limitations, and Delimitations

My assumptions about this study concern the veracity of the self-reported data given to me by the teachers in the interviews that I conduct with them. I must assume that their responses are truthful, at least from their viewpoint. I will try to validate these answers by conducting classroom observations, realizing, however, that a limited number of observations (which will be pre-planned) may not illuminate deviations from what the teachers say in their interviews, and what they actually do in the classroom on a day-to-day basis.

I will be concerned primarily with their science instructional methods, the time spent on science, and their perception of the effect of the elementary science TAKS implementation on their teaching methods. I will not consider other subject areas tested by TAKS, and the instructional methods utilized in these subject areas will not be part of the study.

Chapter Summaries

Chapter II of this study consists of a literature review that provides a more comprehensive background of the study in terms of trends in science education, current research on "best-practice" methods in science education, and research dealing with high stakes testing and its effects on students and teachers.

Chapter III details the methodology of the study, providing information concerning the research design, the setting of the study, and the criteria for the selection of the participants. The method of selecting and collecting the data, as well as the method of analysis of this data are also explored.

Chapters IV, V, and VI contain some background information on teachers from the three schools chosen for this study, including their instructional methods and teaching practices in science, as well as their views concerning the implementation of the science portion of the fifth grade TAKS. In addition, the leadership styles of the administrators of these schools and their views concerning science education on their campuses are explored as well.

Chapter VII consists of a panoramic view of issues involved in science education across grade levels and campuses, particularly those concerned with the research questions stated above, while Chapter VIII deals with additional issues illuminated as the study progressed. Chapter IV concludes the study, with a summary of conclusions as well as suggestions for further research.

CHAPTER II

REVIEW OF THE LITERATURE

Science Instruction as "Best Practice"

Within the scientific and educational communities, there exists a wealth of literature dealing with "best practice" methods of science instruction, although these instructional methodologies are not always adhered to in the science classroom. According to Sandoval and Reiser (2004), traditional science instruction often removes students as discoverers of science knowledge - the teacher is the authority and has all of the knowledge. The students then view the best way to learn as rote memorization and applications of procedures, rules and formulas - but nothing deeper. Students get the "undesirably naive" view that science is an "unproblematic accumulation of facts" (2004, p. 346).

According to Jorgenson and Vanosdall (2002), many teachers have reported their preference for using text books and related written materials when teaching science. Jorgenson and Vanosdall (2002) also claim that students are often passive while teachers lecture – which, according to their study, is still the way science is taught in more than 80% of America's K-8 schools. They propose that the vast majority of schools still resort to the traditional "drill and kill" model of teaching science: "students study textbooks, watch videotapes on various topics, answer the questions found at the end of the chapter, and perhaps observe an occasional demonstration performed by the teacher . . . [yet] year after year, the international comparisons with school systems in

Asia and Europe consistently show that this drill and kill approach is not working well" (p. 603).

On the other hand, the National Science Education Standards (National Research Council, 1996), among many others in the research community, emphasize a hands-on, minds-on teaching methodology in science instruction that encourages higher order thinking through investigative inquiry. Staver and Small (1990) describe this hands-on methodology as "activity-based, materials-oriented science" (p. 87) that properly emphasizes discovery and inquiry through science process skills. Lawson, Abraham, and Renner (1989) have compiled a wealth of research sources which highlight the benefits of such hands-on inquiry methods of instruction in terms of positive student attitudes toward science and science instruction, content achievement, and improved higher-level thinking skills.

Inquiry science is defined as "a process of asking questions, generating data through systemic observation or experimentation, interpreting data, and drawing conclusions" (Sandoval & Reiser, 2004, p. 345). It is science in action - a method of doing science rather than simply reading about it. Inquiry science does not emphasize discrete facts that are committed to memory, but rather encourages the development of the process skills used in scientific investigations (Eick, 2003). Yet, according to Carey & Smith (1993), simply emphasizing these process skills (observation, classification, measurement, conducting controlled experiments, and constructing data tables and graphs of experimental results) is not enough. If process skills are taught outside of the context of authentic science activities, the students will not be challenged to explore,

develop, and evaluate their own ideas (1993). The primary goal of inquiry is to develop the ability to *think.* According to Renner & Marek (1990), science should be taught as a quest in order to foster this ability. When students approach science in this way, they

> use their imagination in assembling the equipment and/or using the materials; data which are obtained are analyzed, compared, evaluated, and classified. Inferences are made and probably tested deductively, and generalizations are synthesized. In other words, students engaging in a quest for knowledge - science - are given multiple opportunities to use and develop their rational powers - the essence of the ability to think (p. 243).

Inquiry science emphasizes investigating the everyday world and developing deep understanding rather than memorizing scientific facts (Marx et al., 2004). The emphasis is on *depth* of conceptual learning rather than a superficial covering of the material (Drayton & Falk, 2002). According to Jorgenson and Vanosdall (2002), students learn over time - "preparing questions, designing experiments, organizing data, and developing conclusions as 'real' scientists do - rather than race through the 'mile-wide / inch-deep' material covered in their textbooks" (p. 602). Students work collaboratively in inquiry-based science experiences and are introduced to science methods that allow them to engage in hands-on, "minds-on" activities - activities that encourage them to discover scientific knowledge themselves rather than wait to be told by the teacher or the textbook (Jorgenson & Vanosdall, 2002).

The major emphasis of inquiry science is that it adopt a view of "doing" science as it is actually practiced: "science as the webs of explanation (theory) by which we

seek to make sense of the phenomena of the world . . . embedded in explanatory context, which has its roots in questions and methods for answering them . . . practiced in the context of constant discovery, argument, and conjecture" (Drayton & Falk, 2002, p. 10-11).

The success of hands-on, inquiry methods of science instruction has been well-documented. According to Bransford, Brown, and Cocking (2000), students at the elementary level have a greater understanding of science concepts when hands-on, inquiry methods are used. Jorgenson and Vanosdall (2002) found that inquiry-based programs in science proved valuable for children of color, females, and those from disadvantaged backgrounds; while Cuevas, Lee, Hart, and Deaktor (2005) found that inquiry experiences increased achievement for all of the elementary students in their study regardless of grade, achievement, gender, ethnicity, socioeconomic status, home language, or English proficiency. In particular, they reported that the low-achieving, low socioeconomic status (SES) students and "English as a second language" (ESL) students showed the most impressive gains. Other research supports the hands-on, inquiry method of instruction as the "best-practice" for science education, particularly in an age of high stakes testing and accountability. Eick (2003) reported that secondary school students using inquiry-based, hands-on activities scored higher on standardized exams.

According to Songer, Lee, & McDonald (2003), successful inquiry-based programs often emphasize the following: a view of science as "preparation for life" rather than preparation for advanced science careers; a view of scientific knowledge as

productive information that can be used to solve real-world problems; and a view of science as dynamic and applicable to the students own lives at the present time and in the future. Drayton and Falk (2002) propose that the goal of science instruction should be to provide educational experiences that will allow students to experience the excitement of knowing about and understanding the natural world, use appropriate scientific processes and principles in making personal decisions, engage intelligently in public discussions about scientific matters, and evaluate evidence and recognize false reasoning as well as counterfactual claims. The use of inquiry methods in an authentic science venue, these researchers propose, will help to achieve those goals.

Science Instruction and High Stakes Testing

Long reported as a "neglected" area in elementary school (Hoffman, Assaf, & Paris, 2001; Ohanian, 2002; Orfield & Kornhaber, 2001; Van Horn, 1995), science has often taken second place to such subjects as reading, writing, and math. Many elementary teachers consistently report a lack of time to adequately teach science, often citing 30-60 minutes per week as an average amount of instructional time (Dickenson, Burns, Hagen, & Locker, 1997; McNamara, Stuessy, McNamara, & Quenk, 1999).

Several experts in the field of educational research attribute this teaching approach to many elementary teachers' feelings of inadequacy in either content or pedagogical knowledge of the subject matter (Kubota, 1997; Supowitz & Turner, 2000). According to Dickenson, Burns, Hagen, & Locker (1997), "It is not unusual for elementary teachers to be less than enthusiastic about teaching science" (p. 295). The message from researchers gives a clear solution to this dilemma - although this solution

is often neglected: provide consistent, sustained, content-based professional development (Ehlers, 2002; Jones, Jones, & Hargrove, 2003; Quinn, 2002; Supowitz & Turner, 2000). With administrative leadership in the schools and central offices often failing to provide such opportunities for their teachers (Scheurich and Skrla, 2003), science continues to be short-changed - both in time allocated for instruction as well as in instructional quality (Jorgenson &Vanesdoall, 2002; McNeil, 2000a).

Other researchers attribute this "shortfall" in science instruction to the fact that, until recently, science has not been a "tested" subject in the high-stakes, standardized-testing world - resulting in the tendency for teachers to spend more time and energy on subjects for which they are accountable (Olson, 2002, 2003; Shepard, 2000; Stecher & Barronk, 2001).

This current trend in high-stakes, standardized testing in public education owes its origins to "A Nation at Risk", a document published by the National Commission on Excellence in Education (1983). This document, endorsed in a speech by President Ronald Reagan, perpetuated the conviction that public education was to blame for many of the ills of society - particularly those of an economic nature (Berliner and Biddle, 1995). With the introduction and nation-wide spread of high-stakes testing over the next twenty years, many politicians and administrators hoped that these tests would provide the impetus for teachers and students to improve their performance, as well as influence instructional content in the classroom (Airasian, 1993).

According to Jones, Jones, and Hargrove (2003), this line of thinking appears to be valid, as teachers report teaching more on tested areas. With the tested subjects of

reading, writing, and math receiving the most emphasis, many researchers have found that high-stakes tests do indeed appear to drive the curriculum, pushing out science and other untested subjects (Gordon & Reese, 1997; Hamilton, Stecher, & Klein, 2002; Harlen, 1992; Johnson & Johnson, 2002). As Edigar (2001) succinctly puts it, "What gets tested is what gets taught" (p. 2).

The focus on high-stakes testing expanded in 2002 with the passage of the No Child Left Behind Act (NCLB), a reauthorization of the Elementary and Secondary Education Act (ESEA) of 1965. This legislation resulted in the addition of several new facets to the high-stakes testing trend on a national level - among them being the requirement to test science at least once in grades three through five, beginning in the 2007-2008 school year (Popham, 2004). With this legislation contributing to the implementation of the fifth grade science TAKS in Texas, and similar tests in other states, some politicians, as well as the public in general, assumed that the ills of science education would be magically "cured" (Peterson, 2002). Some proposed that high stakes testing would improve student and teacher performance in the classroom (Airasian, 1993; Jones, Jones, & Hargrove, 2003; Walker, 2000). Others hoped that these high-stakes tests would highlight achievement gaps between different groups of students - economically disadvantaged and minority students in particular (Scheurich and Skrla, 2003). Still others predicted that these tests would and act as agents of change in curriculum and instruction within the classroom (DeMoss, 2002; McGehee and Griffith, 2001).

However, other researchers now speak of the unintended consequences of high stakes tests. Many are concerned that the curriculum will be narrowed as teachers emphasize only those subjects tested at their grade level, and teach only those objectives specifically covered on the tests (McNeil, 2000a; Hamilton, Stecher, & Klein, 2002; Paris, 2000; Shepard, 2000). Some researchers fear that the emphasis of these high-stakes tests will rest on lower-level learning, focusing more on basic skills than on higher level thinking (Dounay, 2000; Sheldon and Biddle, 1998). Some researchers find a basis for these fears in the proficiency era, described by McNeil (2000a), which flourished during the 1980's and promoted a curriculum of "reductive skill components that could be tested by a multiple choice test" (p. 200). This "proficiency curriculum" consisted of isolated microcomponents of the subjects which were labeled as "proficiencies," with subcategories called "objectives." In math, for instance, the reductionist nature of the proficiencies was evidenced by the greater focus on operational and computational focus rather than higher-level, conceptual knowledge (McNeil, 2000a). McNeil fears the return of this type of curriculum when new subjects, such as science, come under the high-stakes testing umbrella:

> Once subjects come under [high stakes testing in Texas], [teachers] anticipate that their teaching skills will be threatened in much the way it was under the proficiencies. The selection of content, the inclusion of diverse ways of knowing, the reflective component of their students' learning, the relevance of their lessons to their students' cultures and life experiences – all the things that have made

> their teaching successful for them and for their students' futures will be once again in jeopardy (p. 257).

McNeil and Valenzuela (2001) seek to further illuminate how this high stakes testing system affects students' experiences with schooling: "[The testing system] is divorced from children's experience, language, and cultures . . . [it is] not respectful of, nor does it build on, children's personal experiences, the cultures of their families, nor the variations in learning style and interests that span any classroom" (p. 142). This "subtractive schooling" (Valenzuela, 1999) or "cultural denudement" (West, 1994) is only one among many issues that centralize around questions of equity in public education. High stakes tests have been linked to increased drop-out rates (McNeil, 2005) as well as retention rates (Valencia & Villarreal, 2005), particularly for economically disadvantaged and minority students. Jones, Jones, & Hargrove (2003) link these two phenomena, reporting that one grade retention during a student's academic career increases their risk of dropping out of school by forty to fifty percent, while two grade retentions jump the risk of dropping out to ninety percent. Yet, with high-stakes tests increasingly linked to promotion as low as the third grade, there is fear that the grade retention / drop out problems will become even more pronounced.

In a related concern, Kozol (1991) speaks of the "savage inequalities" inherent in public education as some students struggle with lower-quality materials, books, and labs, while they sit in crowded classrooms in ill-repair with teachers that are underpaid and/or under-qualified. Yet these students are still expected to perform to the same standards as those students from more affluent academic environments – newer schools, smaller class

sizes, well-stocked libraries and science labs, computer centers, and highly qualified teachers. Kohn (2000) claims: "The focus among policy makers has been on standards of outcome rather than standards of opportunity" (p. 38). Many researchers express similar concerns with students' unequal "opportunities to learn" in our public schools, particularly when high stakes tests are added to the mix (Berliner & Biddle, 1995; McNeil, 2000; Valenzuela, 1999).

Kohn (2000) also speaks of the erosion of student teacher relationships in a high stakes testing environment as teachers become more focused on passing rates than on the individual child. Many researchers fear that children will experience undesirable levels of stress as they attempt to navigate through an academic career driven by high stakes test scores (Ohanian, 2002).

Still others voice the concern that the response of administrators at the district and campus level will be more concerned with passing rates on these high-stakes test than on providing students with quality education. Sloan (2005) reports central administration response to the high-stakes testing phenomenon as either "reform-focused" (emphasizing teacher development and child-centered, activity-based learning) or "ratings-focused" (emphasizing increased student scores and school ratings) – the latter leading to an overall decline in educational quality.

There is also concern that the external pressure of any mandates issued by state and local education agencies regarding high-stakes testing strategies, etc., will be misinterpreted by teachers and administrators, will be ignored in actual classroom practice, or will lead to symbolic changes in instruction only (Firestone, Mayrowetz, &

Fairman, 1998). In Texas, the average scores on the fifth grade science TAKS since its implementation in 2003 have steadily dropped each year from 74.5% meeting the standard in 2003 to 69% in 2004 and 64% in 2005 - yet another cause for concern among educators (Texas Education Agency, 2004; Texas Education Agency, 2005).

With these issues in mind, several in the field of education have made a call for research concerning the current status of elementary science teaching, particularly in the light of the implementation of the science TAKS (Hamilton, Stecher, & Klein, 2002; Jones, Jones, & Hargrove, 2003). According to Jones, Jones, and Hargrove (2003), a particular concern is that no one seems to be listening to teachers' viewpoints. In this study, however, I was determined to approach these issues from the perspective of the teacher in the hopes of painting what Lightfoot (1986) refers to as a "portrait" of the classroom. As Lightfoot affirms, a "portrait" consists of scientific and artistic integration, providing more "holistic, complex, contextual descriptions of reality, with a belief that environments and processes should be examined from the outsider's more distant perspective and the insider's immediate, subjective view," along with the knowledge that "the truth lies in the integration of various perspectives rather than in the choice of one as dominant . . ." (p. 13). With this in mind, and with my desire to more fully portray the complexity within the classroom, I also sought out the perspectives of campus and district administrators. Their viewpoints provided the background against which the voices, attitudes, and actions of the teachers could be more adequately contextualized.

CHAPTER III

METHODOLOGY

Design

My decision to use a qualitative inquiry framework for this study might seem a far cry from my chosen career as a chemistry teacher. Refined in a crucible of positivism, my research tendencies have always leaned towards a more quantitative style. However, as Eisner (1998a) points out, "The selection of a form through which the world is to be represented not only influences what we can say, it also influences what we are likely to experience" (p. 8). I knew what I *did not* want: a language of objectives, controls, and variables; a view from a distance - impersonal and decontextualized. What I *did* want was to, as Greene (1995) puts it, "see things big" (p. 10) - to view people not as objects or chess pieces, but as individuals living out storied lives on storied landscapes (Clandinin and Connelly, 2000). I wanted to tell those stories as best I could, given my own subjectivities, in order to better understand the responses of these educators to the high-stakes testing environment of the TAKS, particularly as they impacted elementary science education.

With this in mind, I chose narrative inquiry as the framework for my research endeavors, drawing heavily from the works of Connelly and Clandinin (1988, 1995), Clandinin and Connelly (2000), Bruner (1996), and Eisner (1998a) for guidance. I felt that the thick, rich descriptions of personalities, situations, processes, and relationships made more possible through this qualitative, interpretivistic design could more adequately capture and illuminate the voices of the educators I encountered. As a

colleague of mine pointed out, I wanted to "put a face" on the issues surrounding my research – to help others imagine the lived experiences of these teachers and administrators. Greene (1995) proposes that imagination is what makes empathy possible - that it allows us discover how the world of another person looks and feels. According to Eisner (1998a), this ability to truly *see* and not merely *look* requires an "enlightened eye" (p. 1). It is my hope that the narrative inquiry framework of my research will act as that "enlightened eye", fostering a personal, empathic connection between the reader and the teachers who lived these stories.

From an epistemological standpoint, my chosen qualitative framework may appear at odds with the dominant empirical, rationalist underpinnings found in the sciences. However, Bruner (1996) disagrees: "A respectful, tough-mindedness toward alternative 'stories' about how things are, how they might have come to be that way, and where they might be going is in no sense antithetical to scientific thinking" (p. 92). He does, however, propose that different research questions require different methodological frameworks, particularly when human beings are involved: "[N]either the empiricist's tested knowledge nor the rationalist's self-evident truths describe the ground on which ordinary people go about making sense of their experiences . . . These matters need a story" (p. 130). He continues:

> We devote an enormous amount of pedagogical effort to teaching the methods of science and rational thought: what is involved in verification, what constitutes contradiction, how to convert mere utterance into testable propositions, and on down the list. For these are the "methods" for creating a "reality according to

> science." Yet we live most of our lives in a world constructed according to the rules and devices of narrative (p. 149).

According to Bruner (1996), narrative inquiry focuses more on an "interpretive-hermeneutic" approach rather than a "causal-explanatory" approach. Distinguishing between these two approaches, he continues:

> Actions have reasons. What people do in narratives is never by chance, nor is it strictly determined by cause and effect; it is motivated by beliefs, desires, theories, values, or other "intentional states" . . . The search in narrative is for the intentional states *behind* actions: narrative seeks reasons, not causes (pp. 136-137).

It follows, then, that the heart and soul of narrative inquiry lies in experience. To the question, "Why narrative?" Clandinin and Connelly (2000) respond "Because experience" (p. 50). These researchers see narrative inquiry as a method that lies at the opposite end of a continuum from the "controlled-plot hypothesis tester" (p. 76), and view the aim of narrative inquiry as "experiencing the experience" as well as "understanding and *making sense* of experience" (p. 80). Although Connelly and Clandinin realize that the central ideas of narrative (plot, character, scene, place, time, point-of-view) might create "dissonance" for many readers, they nevertheless propose that narrative inquiry, with its emphasis on stories lived and told, is the best way of representing and understanding experience.

Narrative inquiry reveals aspects of the teachers' lives that could not be as adequately expressed using other methodologies. Although it is tempting to try to

position narrative inquiry within and among other types of qualitative research styles - phenomenology, with its focus on the participants' and researcher's first-hand experience of some phenomenon (Merriam, 1998), comes to mind - Clandinin and Connelly (2000) suggest that such categorizations be avoided. Rather, they describe narrative inquiry, not by where it fits into some large methodological puzzle, but by what narrative inquiry itself must contain: description, narrative, and argument.

> Parts of our research text can be composed of rich descriptions of people, places, and things; other parts can be composed of carefully constructed arguments that argue for a certain understanding of the relations among people, places, and things; and still others can be richly textured narratives of the people situated in place, time, scene, and plot (p. 155).

They go on to propose that, although different narrative inquiry texts may contain varying amounts and degrees of these constituent elements, each of the elements must be present.

With the requirements of description, narrative, and argument in mind, I focused on the lived experiences of teachers and administrators in public elementary and middle school settings – and in particular on what Connelly and Clandinin (1995) describe as teachers' "personal practical knowledge." This personal practical knowledge consists of "a body of convictions and meanings, conscious or unconscious, that have arisen from experience (intimate, social, and traditional), and that are expressed in a person's practice" (p. 7). By focusing on these teachers' personal practical knowledge, or their lived and embodied experiences, I hope – with the elements of description, narrative,

and argument - to illuminate their experiences of in a "TAKS world" as storied lives on storied landscapes.

These "storied landscapes" derive from the "professional knowledge landscape" described by Connelly and Clandinin (1995) as "an intellectual and a moral landscape" (p. 5) that is composed of a wide variety of relationships among people, places, and things. Although professional knowledge landscapes encompass lived and embodied experiences both in and out of the classroom, my focus will be on that portion of the landscape that encompasses the classroom. According to Connelly and Clandinin, classrooms occupy a special place within professional knowledge landscapes. Classroom are "places of action where teachers teach and where curriculum is made, at least the curriculum that matters as far as students are concerned" (1995, p. 12). Within these classrooms, teachers know their lives in terms of stories: "They live stories, tell stories of those lives, retell stories with changed possibilities, and relive the changed stories" (p. 12). My goal is to re-present the stories of these teachers, to the best of my ability, as their stories have morphed and shifted, and to create a "storied landscape" of the teachers' experiences while adjusting to a "TAKS world" in the elementary science classroom.

Yet I also view my research as a portrait, as suggested by both Connelly and Clandinin (1988) and Lightfoot (1986). Like these researchers, I do not feel that the concepts of "storied landscape" and "portrait" are mutually exclusive, but are, in fact, complementary. As a high school science teacher, I often remind my students as they attempt to provide explanations for laboratory experiences, that although "a picture is

worth a thousand words," a picture *with* words is priceless. Eisner (1998b) points out that one purpose of research is to produce works of art. Like all works of art, he claims, this "artistically crafted research" makes the obscure more vivid, directs attention to individuality, makes empathy possible, and possesses a sense of wholeness that makes credibility possible as well - thereby producing a more powerful and illuminating work of art. "Artists need skill, discipline, imagination, sensibility, and insight, and so do those doing social science research" (p.154). As I mentioned earlier, my desire is to put a face – a human face - on the issues involved as teachers make sense of and then respond to the science TAKS in their classrooms. Painting a picture (a landscape, if I may) with my words will, I believe, help to accomplish that goal.

I want my voice - my signature - to be present throughout this inquiry. My own story as a teacher allows me to experience the world in a unique way. I am a passionate teacher - emotion and "heart" thread throughout my lived experiences. Far from being detrimental to my research, however, I feel that this has added another dimension to the images I hope to develop. As Eisner (1998a) posits: "These unique ways of experiencing [the world] make possible new forms of knowledge that keep culture viable" (p. 48). I have many subjective selves - single mother, doctoral student, scientist, teacher, musician, friend, daughter. This multi-plurality of selves provides alternative viewpoints which are all brought to bear in this research, and this multiplicity, I feel, adds a sharper relief to the experiential landscape I hope to portray.

Nevertheless, according to Clandinin and Connelly (2000), there tends to be a rule in research that texts should be written almost as if there were no personal inquirer –

no "I' in the process. However, I wanted that personal "I" – the "I" that "grows out of the ambiguous, shifting participant observation relationships, the 'I' who learns by seeing and telling stories along the way, and who writes stories of relationship" (p. 9). Clandinin and Connelly continue: "As we write 'I', we need to convey a sense of social significance. We need to make sure that when we say 'I', we know that 'I' is connecting with 'they'" (p. 122). That relational aspect between the participants in my study and myself is of prime importance within my narrative inquiry framework – hence the "I" throughout my written text.

Finally, whether creating a story or portrait - or a combination of both - I wanted to approach my research from an exploratory, "discovery-oriented" mindset. The emergent and artistic nature of qualitative inquiry in general, and narrative inquiry in particular, allowed me the flexibility to adjust the direction of my research as needed. I felt that with this emergent design, and without the constraint of a preconceived hypothesis, I could more closely follow the advice of Josselson (1995): "If we listen well we will unearth what we did not expect" (p. 30).

Setting

My research study focused on one school district in North Texas. This rural school district, Atkins ISD, traces its origins to a one-room, log school house built in 1846 by a settler near a creek on his land. From these humble beginnings, the school district grew over the past 160 years and now encompasses portions of three counties and includes five incorporated cities. This "academically acceptable" district, according to the state's Academic Excellence Indicator System (AEIS), enrolls approximately 5900

students. Of these students, 88 % are white, 10 % are Hispanic, and the remaining 2 % are African American, Native American, and Asian / Pacific Islanders. Thirty-four percent are economically disadvantaged while 37 % are labeled "At-Risk". The district sports five elementary schools (kindergarten through grade four), two middle schools (grades five and six), two junior high schools (grades seven and eight), and one high school. These schools, as well as their AIES rating for 2004-2005 are shown in Table 2 below (schools participating in the study are in italics):

TABLE 2
Atkins ISD Schools

School	**Type**	**Rating**
Lone Pine	*Elementary*	*Recognized*
Clarksville	*Elementary*	*Recognized*
England	Elementary	Recognized
Washington	Elementary	Exemplary
Stockton	Elementary	Acceptable
Harrison	*Middle*	*Recognized*
Atkins	Middle	Acceptable
Freeman	Junior High	Acceptable
Atkins	Junior High	Acceptable
Atkins	High School	Acceptable

SOURCE: Texas Education Agency (2005)

Sprawled along the southwestern side of a large lake, with a population of ten thousand, the city of Atkins has a small-town, rural flavor, yet is well within commuting distance (fourteen miles) from a large city. As a result, the school district provides education to students from both affluent and economically disadvantaged families . . . and everything in between. From "ropers" dressed in western gear to "goths" dressed all in black, the students mix and mingle in the hallways at each school. At times the clash between different groups can cause some tension among the students, but for the most part, discipline is not a major issue in this school district. In fact many of the teachers in the district report teaching here, despite salaries that are lower than average for this area, because of the relative lack of discipline problems with students.

One of the district's middle schools (which will be referred to as Harrison Middle School for this study) enrolls approximately 400 students. Two of the elementary schools (which will be referred to as Clarksville Elementary School and Lone Pine Elementary School) are "feeder schools" for Harrison, and enroll approximately 400 students each. These two schools, along with Harrison, were the focus of this study. The choice of these schools stemmed from my desire to use a "cluster" of schools in order to obtain a more cohesive view of community identity in and among the schools, as well as vertical teaming strategies within the system.

Subjects / Interviewees

The interviewees for the study consisted of sixteen teachers in all - one teacher from each grade level, first through fourth, at each of the two elementary schools, as well as all four fifth-grade science teachers at Harrison Middle School. An additional

second grade teacher from Clarksville Elementary as well as a fourth grade teacher from Lone Pine Elementary were interviewed when an observation period for the original teachers at those grade levels could not be finalized due to scheduling conflicts. Most of these teachers were selected on the basis of recommendations from their principals as well as their reputation throughout the school and district as "good" teachers - dedicated individuals who demonstrated an "ethic of care" (Noddings, 1998) with their students. In addition, each of these teachers had at least four years of teaching experience, a necessary criterion in order to obtain their views from both before and after the science TAKS implementation. The purposive sampling process was necessary to obtain these more experienced teachers, as well as to ensure that they had different grade-level assignments. Four additional subjects in the study included the principal of each of the three schools and the superintendent of the school district. A total of twenty subjects comprised the list of those formally included in the study. (Table 3, Table 4, Table 5, and Table 6 list the interviewees for this study.)

TABLE 3
Lone Pine Teachers

Teacher	**Grade**	**Years Experience**
Sandy	1	21
Moira	2	6
Cris	3	29
Mandy	4	26
Ricki	4	4

TABLE 4
Clarksville Teachers

Teacher	Grade	Years Experience
Carrie	1	21
Becky	2	11
Lori	2	13
Helen	3	26
Chloe	4	5

TABLE 5
Harrison Teachers

Teacher	Grade	Years Experience
Theresa	5/6	15
Josie	5	12
Carla	5	8
Katie	5	5

TABLE 6
Administrators

Name	Job Description	School / District
Dr. Edwards	Superintendent	Atkins ISD
Andrea Taylor	Principal	Lone Pine
Gillian Dean	Principal	Clarksville
Barbara Kildare	Principal	Harrison

In addition, as other teachers, administrators, and parents discovered the context of this study, several conversations occurred outside the formal interview process. Excerpts of these conversations were included in the study as well.

Data Collection

My data collection method was very field-focused. I wanted to go into the schools, visit the classrooms, observe the teachers, and describe the settings "as they were" (or at least as they were within my interpretive framework). I wanted to "look around" - paying attention to the particulars (Eisner, 1998b). I wanted to give the landscape texture, background, shadows, and light. As Clandinin and Connelly (2000) point out, narrative inquiry is relational. With that in mind, I focused on the interview and observation processes as my primary methods for data collection. I carried out at least one 30-90 minute interview with each of the teachers, as well as several informal conversations. I also interviewed each of the principals and the superintendent of the school district. I audio-taped these interviews and transcribed them as soon as possible to ensure accurate impressions of the interviewees. I requested the teachers' lesson plans, finding that lesson plans for the current school year were readily attainable; however, none of the teachers could produce lesson plans from previous years - many of them having been discarded or "typed over" after the conclusion of the previous year. I did obtain copies of sample science activities they currently used, and lists of science materials purchased. In addition, I attended each of the science inservice opportunities provided for the elementary teachers by the district at the beginning of the school year,

as well as meetings of the Instructional Specialists and the District Leadership Team (DLT), recording all observations as field notes.

Informal conversations with other teachers from the schools involved in the study, as well as with some of the parents of students at these schools, were recorded as soon as possible. I was amazed by the interest in the study. Teachers and administrators from other schools, both in and out of the district, asked to be interviewed, although this was impossible due to the scope of the study. I later drew upon some of these conversations, however, when I began writing the results of the research.

After the formal interviews of the participants were concluded, I observed each of the teachers in their classroom as they taught a science lesson, recording field notes during the observations. According to Clandinin and Connelly (2000), "Field texts help fill in the richness, nuance, and complexity of the landscape, returning the reflecting researcher to a richer, more complex, and puzzling landscape than memory alone is likely to construct" (p. 83). I therefore transcribed my field notes as soon as possible in order to recall, as accurately as possible, the conditions surrounding the interviews. Primarily, I wanted to ensure that I captured the emotional aspect of the field experiences - the laughter and the tears (which fell freely at times). This was perhaps one of the more surprising outcomes, as I continually connected to the interviewees on a very personal and emotional level - even though I had never even spoken to the majority of these teachers before the study began.

As Clandinin and Connelly propose, "we are in the parade we presume to study" (p. 81). I was a part of my study - in essence, the research instrument. This does have

distinct advantages over non-human instruments in the research process, according to Merriam (1998). I could be more responsive to context, adapting techniques to circumstances. I could be sensitive to nonverbal aspects of the observations I made, considering the whole context. I could also process data immediately and explore anomalous responses. However, in order to do this, I needed to, in a nutshell, listen well, question closely (both myself and my interviewees), and observe details (Bogdan & Biklen, 2003) within a conceptual framework of intersubjectivity and its aggregation of views from various perspectives (Noddings, 1998). Perhaps it was my total preoccupation with what they had to say that allowed the interviewees and myself to connect - my undivided attention that said to them, "What you have to say is important to me."

Methodological Constraints

A classroom is complex and "messy" - definitely a multi-variable environment - which means giving up the notion of controlling variables (Cochran-Smith & Lytel, 1999). We can seldom understand how people involved with our research think, and it is virtually impossible to predict how participants will react to the research situation. In addition, although there are definite advantages to the researcher acting as the research instrument, there are also disadvantages as well: they can make mistakes, miss opportunities, and allow personal bias to interfere (Merriam, 1998).

This bias or subjectivity - termed a "speed bump" by Weis and Fine (2000), can be problematic. According to Bogdan and Biklen (2003), teachers' experiences, background, and out-of-school life affect their viewpoints, and they often make

assumptions (as most of us do) with little or no evidence. As a researcher, I had to remain constantly aware of these subjectivities - more or less in a sustained state of "wakefulness" (Clandinin and Connelly, 2000). According to Peshkin (1988), our subjectivities are like "a garment that cannot be removed" (p. 17). He continues to note that the risks involved by not remaining meaningfully attentive to these subjectivities throughout the research experience include a distortion of views (resulting in ignoring some data), distraction from other viewpoints, interference by my own hopes for what the "truth" is, and the loss of a non-judgmental stance - making me defensive so that I am unable to see *around* an issue. I had to constantly problematize my subjectivity (Kumashiro, 2004), particularly considering my concerns with the science TAKS at the high school level, which I am opposed to on a variety of levels. I had to concentrate on keeping an open mind to the effects of the science TAKS on elementary education by truly listening to the teachers and administrators, carefully (and non-prejudicially) observing classroom activities, and thoughtfully analyzing the artifacts that I collected. Peshkin (1985) also points out the virtues of subjectivity, however: "By virtue of subjectivity, I tell the story I am moved to tell. Reserve my subjectivity and I do not become a value-free participant observer, merely an empty-headed one . . ." (p. 280). Harnessed appropriately, my subjectivities under-girded and supported my unique point of view.

Finally, according to Smith (1990), there is an ethical constraint to any research situation. The requirement of making "caring decisions" in such situations is always paramount (Goldstein, 1997). I therefore worked to ensure that the teachers' interviews

were private, with tapes and transcripts kept in a secure place; that their names, as well as the names of the schools, were coded; and that I did not discuss any portion of the interviews that might compromise the identities of the teachers or the schools involved in the study.

Analytical Framework

Once I collected the data, the process began to focus, as proposed by Coffey & Atkinson (1996), on the fitting, manipulating, and matching of the data. Lofland and Lofland (1995) define analysis as "the *emergent* product of a process of gradual induction [emphasis in the original]" and the finding of numerous "propositional possibilities" (pp. 83-84). It was time to begin the process of determining those possibilities within my narrative framework.

I first made a file for each of the teachers and took these files home in the interest of confidentiality. Rather than trying to view the teachers as a homogeneous group, I tried, as hooks (1994) cautions, to avoid that essentialism, instead adopting the stance that everyone was an individual with their own reality. Rather than viewing them as univocal or unidimensional, I focused on the mulitiplicity of voices that needed to be heard (Clandinin and Connelly, 2000). As Josselson (1995) claims, "When we aggregate people, treating diversity as error variance, in search of what is common to all, we often learn about what is true of no one in particular" (p. 32). I made a sincere attempt to always treat each interviewee as an individual in their own particularity, with their own view of reality.

After organizing the information in file folders, I then began coding the information, breaking up and segmenting the data into simpler, general categories (Coffey & Atkinson, 1996). I "interrogated the data" by reading and re-reading it, and then developed a map of the codes in an attempt to "discover the data" and see the "whole picture" (p. 31). Throughout this process, I began to find "patterns, narrative threads, tensions, and themes" (Clandinin and Connelly, 2000). In keeping with the narrative form of analysis, these patterns then allowed me to begin the process of interpretation. After this coding process, I then made additional copies of the transcripts and began the process of "cutting and pasting" these coded comments onto large sheets of paper, each labeled with a particular theme and colored coded for each different school. With this method, I could see, at a glance, all of the comments made by the teachers about a given topic, but I could also easily distinguish the particular school from which they originated. Although a more efficient method might have been devised using some of the computer programs currently available, I am a very kinesthetic individual, and this hands-on method of organization proved invaluable as I began the writing process.

The act of making sense is at the heart of meaning-making and understanding (Courtney, Merriam, & Reeves, 1988). Connelly and Clandinin (2000) propose that we should strive to create a three-dimensional narrative space in the storied landscape: *situation* (the place or location), *continuity* (the past, present, and implied future), and *interaction* (the personal/inward and social/outward). Throughout my research "story," I

attempted to provide this three-dimensional framework as I sought to help others visualize, from my writing, the lived stories of these teachers.

In my quest for meaning and understanding, however, I faced additional considerations. According to Bruner (1996), "Understanding is the outcome of organizing and contextualizing essentially contestable, incompletely verifiable propositions in a disciplined way" (p. 90). So the big question remains: "How do I have any sense of trust that my research has been analyzed / interpreted 'correctly?' " Although many in research refer to validity, reliability, and generalizability as the cardinal requirements of any research endeavor, others feel that these terms are not applicable to qualitative research. Smith and Heshusius (1986) suggest substituting credibility for validity, and dependability for reliability. They go on to suggest that credibility is fostered by the gathering of thick, rich descriptions, while dependability can be achieved when others agree upon the interpretation after they share in dialogue and justification. Wolcott (1990) claims that in order to achieve credibility, one doesn't *tell* another what to think, but *shows* them, by recording accurately, reporting fully, and being candid with oneself and others. Firestone (1987) suggests an audit trail of the data collection and analysis process, while Smith and Heshusius (1986) as well as Mathison (1988) - among others - suggest the process of triangulation as a method to increase credibility. Triangulation - referred to by Eisner (1998a) as "structural corroboration" (p. 55) - utilizes a variety of data sources to obtain a richer and more complex picture of the phenomenon, and provides more and better evidence from which researchers may "construct meaningful propositions" about the world (Mathison, 1988, p. 15). These

data sources consisted of interviews and classroom observations, as well as artifacts and documents. The shift, according to Mathison, is away from validity to the "construction of plausible explanations" (p. 17). The thick, rich data provided by triangulation provides that credibility, as well as the basis for dialogue and justification in the quest for dependability.

Finally, during the writing process itself, I utilized the technique of peer editing (e-mailing and sending hard copies to fellow teachers and graduate school colleagues for their perusal), as well as member checks (consisting of teachers reading portions of my interpretation of their contributions). Feedback from these sources proved very beneficial, both in the mechanics of my writing and in the story I wanted to tell.

With this narrative analytical framework, I hope to produce, not a mirror - a sterile surface reflection, but a portrait - a storied landscape. Portraits have depth, texture, context, individuality. Narrative inquiry digs beneath the surface in order to interpret the lived experiences of real people in diverse, but connected, situations . . . that is what I hope to portray here.

CHAPTER IV

LONE PINE ELEMENTARY SCHOOL

The single-story, light tan building perches on a hilltop surrounded by a smattering of tall, stately trees, a few small houses dotting the countryside in the distance. Flags flutter overhead as I walk toward the entryway of the school, above which a green and white banner proudly reads, “A Texas Education Agency Recognized Campus: 2004-2005". Stepping through the glass doors, the large paper trees that line the hallways grab my attention. Hanging from their branches, leaf and apple cut-outs bear the names of students who have earned Accelerated Reading points for the year, attesting to the importance of this program in the school. Examples of student work are scattered among the “trees” and flank the classroom doors as far as I can see down the corridors both left and right. Ahead, the noisy hustle and bustle of children laughing, talking, and shuffling along mark the entrance into the cafeteria, where a stage takes preeminence at the front. Orderly lines of boys and girls marching to the bathroom or back to their classrooms with “buzzies in their hives” (hands behind their backs with one thumb in the opposite fist) remind me that I am in an elementary school and not in the controlled(?) chaos of a high school hallway.

Built in 1979, Lone Pine Elementary hosts children from kindergarten through fourth grade. The area of the community served by this school has the greatest percentage of economically disadvantaged students (55.3%) in the district, as well as the highest mobility rate (29.6%). Andrea Taylor, the principal at Lone Pine, has provided the leadership at this school for the past two years. A graduate of Texas A&M

University, Ms. Taylor is a young, dynamic individual who exudes enthusiasm. After teaching third and fourth grade for ten years, much of it in the Gifted and Talented (GT) program, this is her fifth year as an administrator in the district and her second year as principal at Lone Pine. An articulate speaker who handles herself well in private conversations and public meetings alike, she demonstrates her innate intelligence and her knowledge of the education field. Ms. Taylor is also a firm believer in the benefits of science education at the elementary level, having taught at this school herself for several years, and places particular value on the use of hands-on methods of instruction:

> Science is so important. I think that you're laying the foundation for investigation in all areas. You've got to have hands-on investigations or the students aren't going to grasp those concepts that can only be experienced from doing it, not just reading about it. It's ever-changing . . . and if you do it right it's very high interest . . . I definitely think you should start at the kindergarten level.

Describing herself as "highly self-motivated", Ms. Taylor needs little in the way of pressure from higher authorities to strive for higher TAKS scores or school ratings: "You know, for me personally, I want my school to be the best, so our administration doesn't necessarily have to apply any pressure . . . It comes from me - it comes from internally." Her own personal attitude translates into the conviction that her teachers feel that same internal motivation: "We're all working as hard as we can to achieve success." During the past two years, Ms. Taylor has introduced a new math program to help the students in her school achieve greater success in that subject, and has strongly encouraged her teachers to emphasize writing at all grade levels – not merely the fourth

grade, where the writing TAKS is given. Yet Ms. Taylor's encouragement in the area of science education seems somewhat less focused. She tells me of her expectations for her teachers: "I expect them to teach the TEKS and follow the district's scope and sequence", but she does not attempt to micro-manage her teachers. "Some classes will have a set science period, but also if they want to choose to do some science skills in the language arts or in the math especially, I encourage that a lot." Suggesting that the teachers integrate science more with other subject areas (she mentions several times that she often tells her teachers to "teach smarter"), she doesn't require a specific amount of time for science on her campus. Her attitude toward professional development in science for her teachers appears somewhat less focused as well. "I can't recall what we've done for science," she admits. When asked whether she requires attendance at science workshops or district inservice offerings in science, she replies, "No, no I don't. Not yet." She leaves these decisions up to the teachers. As a fairly new principal at this campus, she has not jumped in with strict mandates or directives concerning science teaching and professional development. "I just didn't feel that I could come in here and make sweeping changes my first year as principal. I've been on the other end of that situation as a teacher," she states. Against this backdrop, several approaches toward teaching science emerge across the campus.

A First Grade Perspective: Making a Difference

"Do we eat plants?" Sandy asks her students. "No!" comes the unanimous shout from the group of first-graders gathered on the special carpet at the front of the room. Sandy smiles. Thus begins her science lesson for the day. She crosses over to her desk

and picks up a large brown bag with "LUNCH" written across the front. As she begins to pull items out of the bag - carrots, raisins, apple juice, a peanut butter and jelly sandwich, an oatmeal cookie - the students join her in categorizing each item as "plant", "made from a plant", or "something other than a plant" and placing pictures of the items on a large graph on the wall. "How many things are made from plants?" she asks. "Six!" they chorus. "How many things are other than plants?" she continues. "Zero!" "Do we eat plants?" she finishes. "Yes!" they yell enthusiastically. She's turned them around . . . except for one hold-out in the back of the group who still shouts, "No!" She changes her mind when Sandy asks her to look at the graph on the wall, but later Sandy laughs, "Sometimes you think, 'Man, I've just wasted the last forty-five minutes!'"

The students continue the activity with observations. Each of the lab groups has oats, wheat, peanuts, a potato, or an orange at their station. Each student has a "maggot glass", as one student calls it ("magnifying glass," Sandy patiently corrects). Sandy instructs them to use the magnifying glass to observe the materials at their station. The students are excited - they're looking at everything: the items on their table, their clothes, their skin, their hair . . . one student looks curiously up his neighbor's nose. Another student picks the shells off of a peanut at her station and eats the shell, while another calmly spoons wheat flour into his mouth. Sandy is unperturbed, roaming from station to station, focusing the students on what they're supposed to be doing. It's noisy and messy and altogether a wonderful lab. Every few minutes the students change to a different station. I expect this to be chaos, but it's obviously a familiar activity for the students - they know exactly where to go. They are all fascinated by what they see at

each station. "This is what's in an oatmeal cookie? I thought they just came from a grocery story!" "I thought they came from milk." "From milk?? How did you figure that??" The goal of the lab is to demonstrate how people (and other animals) depend on plants for food. Listening to the students' comments, it's easy to see how much they're learning from this simple activity.

"Use your six-inch voices!" Sandy says over the students. Amazingly, it works, and the students quiet down. ("Would this work in my high school classes?" I have to ask myself.) She is busy handing out the apple juice and oatmeal cookie treat that will culminate today's lesson. Everything has gone so well that I begin to think that this must have been a "canned" lesson for my benefit. However, I overhear Sandy's aide comment that it went more smoothly this year than last, and I realize that it's not a "dog and pony show" but simply a dedicated and talented teacher attempting to provide her students with valuable hands-on science experiences on a regular basis.

"We found a cricket!" three students exclaim as they're cleaning up by the sink. "Oh, it was too cold to put him outside this morning so I put him in one of the plants," Sandy tells them. The students laugh - evidently this is nothing new from their teacher. This soft-spoken, twenty-one year veteran first grade teacher is definitely a science buff. In fact, you can talk to teachers at every grade level at Lone Pine about science education and eventually Sandy's name will come up. "She's just so excited about science, she gets us excited, too!" claims another first grade teacher at the school. "We all started really getting into science last year when Sandy ordered a bunch of new science kits. We're really starting to get it together in first grade." Sandy has spear-

headed something else that is new this year. Each of the four first-grade teachers has developed a lab dealing with plants, and they are "trading kids" each Friday of the month so that every student will be able to participate in each of the labs. "We're planning for several more of these in the spring," Sandy smiles. If, as the principal from another elementary school claims, "one teacher can make a difference," then Sandy is that teacher at Lone Pine.

When asked whether the implementation of the fifth-grade science TAKS had influenced her science teaching, Sandy replies: "I don't feel much pressure to teach science at all at the first grade level . . . it's just not stressed at this grade level. Just math, reading, and writing." She is convinced that this is because of the TAKS topics: math and reading in third grade, with writing added in fourth. With the science TAKS in mind, Sandy has worked on her own to revamp many of the labs she does with her students.

> I've taken all of these activities from the book and made them into centers. And what I've tried to do (it's really simple - you can't do it with all of the investigations, but you can do it with some) is to turn it around and do it in the 'scientific process' - the 'scientific method.' They come up with their hypothesis and we test it . . . it's more hands-on.

She also spends more time on science now, although it's still only about an hour per week, with another hour per week spent on vocabulary and book-work. With no set requirements for science time or instructional strategies, the teacher sets the tone in her own classroom, as Sandy points out:

> I think it would depend on the teacher. Some teachers have gotten on board and done basically what I have done, but there are some others that have not changed. We do have one teacher that's kind of 'old-school'. She's just 'open the book'. She doesn't bring anything in when we're talking about rocks, she doesn't bring any different types of rocks in. When we're talking about soils, I bring in different types of soils. She probably doesn't even have a magnifying glass. She is just straight from the book, read the text.

Continued training in science instructional methods is not stressed, either, according to Sandy. "The BLT said that teachers would be encouraged to go to workshops and things like that - but that's just in writing," she laughs. "It's more on your own." The lack of mandates or clear direction for science from the campus or central administration, as reported by each of the principals in this study (and corroborated by the superintendent), makes Sandy's efforts at improving science instruction for her students, and for all students at her grade level, even more remarkable. It seems that one person *can* make a difference.

A Second Grade Perspective: It's All About Attitude

Talk to Moira about science education, and you'll soon recognize another teacher who loves science:

> I'm just a science guru . . . Children learn so simply - just seeing things. We dissected a lima bean in class. And we used the little trays and we used the little pins and we got all the tools to do it. But to see the seed coat and hold it in their hands and see how tough it is and understand how that can protect the little

> meaty part . . . they could actually see inside the bean . . . I mean that was the simplest of things. And they wanted to *keep those beans* and take them home at the end of the day. I mean, we had a 'prize' there - we had a bean with a little plant and we were going to keep it! So I could have given them a million dollars and they wouldn't care - they had a BEAN!! And that didn't take any effort to let the children see that instead of in a book.

Yet despite Moira's enthusiasm and her position as the lead science teacher in the second grade, she reports that many of the teachers in the school don't feel the same way about teaching science.

> I was the only one that did [the bean dissection] at the second grade level. It's frustrating when I say, 'Well, I'm going to do this experiment,' and they're like, 'They're just going to take the beans and put them up their nose.' My kids don't put beans up their nose. You know you just have to stay on top of them. If you had a group of children that couldn't walk down the hall properly, would you quit walking down the hall? I don't think so . . . you'd keep working on it!

Watching Moira in action with her students, it's obvious that she has indeed worked with her students in order to allow hands-on activities to go as smoothly as could be expected with a group of nineteen seven- and eight-year-olds. A second-grade teacher for the past six years, she is quick to laugh and very open in her conversations about teaching and the school environment at Lone Pine. In an effort to integrate language arts with other subjects, she often begins her science lessons by reading a short book dealing with the topic of the day – sometimes fiction, sometimes non-fiction.

Today's lesson deals with the brain and the senses, so Moira is reading a non-fiction book about the brain to the students, showing them pictures as she reads. The students are attentive, listening quietly. Surrounding them, the room is a kaleidoscope of color – spider webs made of glue hang from styrofoam plates, skeletons hang from the ceiling, fall leaves made of construction paper are scattered over the walls, and pumpkin name-tags are taped to each locker. I sit in a small student chair in a corner of the room, wondering if this artistic ability is an innate characteristic of elementary teachers. I sheepishly think of my classroom's lone bulletin board, unchanged in the past five years.

Moira begins to hand out plastic bags containing cotton swabs. The swabs are stained orange on one end. "Do not open your bags until I give you complete directions!" she orders. The students are getting loud now – they *really* want to open those bags. "Put the bags down!" Moira is not upset – she seems to fully expect this level of excitement. "When I tell you to, open the baggie and hold your nose as fast as you can. Then pick up the orange end of the Q-tip and rub the white end on your tongue. THEN let go of your nose." She waits until they have quieted down and demonstrates for them. "Okay, go!" she cries. The students madly scramble to open their baggies and hold their noses. Cries of "Cool!" and "Ooh, yuck!" echo throughout the classroom as they touch the Q-tips to their tongues and release their noses, mixed with a great deal of laughter and squeals of excitement. The white end of the Q-tip has been dipped in peppermint flavoring. Moira is laughing as well, clearly enjoying the activity herself. It takes some time, but eventually, she manages to start the classroom discussion. Each of the students agrees that their sense of taste was much better when they were able to

smell as well, clearly establishing the relationship between the two senses. Other activities follow (one bravely involving several open containers of water at every group "station"), each demonstrating one of the senses. The students listen remarkably well to directions of "Keep your hind-ends in your seats" and "Keep your hands out of the water until I give you directions". A few minor mishaps occur, but Moira is unperturbed, quietly repeating directions and focusing the attention of a few wayward students. "Isn't the noise great?" she asks me. After twenty-four years of teaching science myself, I have to agree.

Although it's obvious that Moira enjoys teaching science, scheduling science activities daily, with hands-on activities at least once or twice a week (as evidenced from her lesson plans), she sees math and reading as getting the majority of the emphasis at this grade level.

> I feel a lot of pressure to do math and reading . . . I really don't feel any pressure at all [to teach science]. I mean, we don't teach science every week. We switch with social studies. Two weeks we do science, two weeks we do social studies . . . I teach it for about an hour a day . . . but I really don't feel any pressure at all . . . All I've heard this year is that we're going to teach math, math, math, and more math . . . When they've got to pass reading and they've got to do better in writing and they've got to get that math score up - the science TAKS isn't even in the elementary until fifth grade and we don't have fifth grade at this campus, so guess where science goes. Out of sight, out of mind.

When asked whether the implementation of the fifth grade science TAKS has

influenced the amount of time spent on science or on science instructional strategies, Moira replies,

> I don't think it's really affected it at all . . . I do not think that as a whole the school has changed the way they teach science - I think that it gets brushed aside a lot . . . I don't think [science instruction] is going to change until . . . they have to pass the test. That's when it becomes really important. It's like, okay, here's the test, get on the bandwagon of science - when they have to pass it.

Moira feels that the attitude of the teachers has a larger influence on science instruction at the school than any other factor.

> I think some of the teachers that have been here for so long where [science] was not important, well it's the same way with technology: 'I'm not going to bother to learn this. I'm only going to be around another five years.' I mean, we got to spend some money on science . . . but it's not being stressed that we use those supplies or that we even go to workshops to find out HOW to use those supplies.

It remains up to the individual teacher to determine how much science will be taught as well as how it will be taught in their classroom.

There are no facilities available for lab use, perhaps contributing to many teachers' lack of enthusiasm for teaching science. Although the principal, Ms. Taylor, says that there is a room available for use as a lab, she doesn't see completion of the lab set-up until next year: "We have a room designated already and we have taken inventory so to speak of materials that we have and that's in there. That's one of our goals this year is to beef that up. I know it's not going to happen this year, but we're

working towards that," Ms. Taylor claims. However, Moira emphasizes the need for such a facility:

> I think that we should have a room that has tiled floors so that we can do science properly, because they're so worried about this carpet you know. And then last year they went out and bought everybody fire extinguishers and eye wash stations. Well what? We don't have any room, any space to do labs . . . We're going to need to get the microscopes, the petri dishes - they need to know what these objects are before they read about them in a story . . . they need to *know* what those objects are that they're reading in the questions and they need to know how to use those materials - the balance, the scales, you know, whatever . . . I think if we had a lab that teachers could take the children to and the stuff was in there and we didn't have to worry about spilling it on the floor or in their desk or catching something on fire in the classroom (or whatever!) that the teachers might be more willing to go.

Yet it often becomes the individual teacher's responsibility to provide materials for the students to use in science activities, as Moira points out:

> I had to buy meal worms [for an earlier activity this year] with my own money . . . we're not given much of a budget for science equipment . . . we've already done parts of plants and I had to bring in all that out of my own money as well. So a lot of the science that I do has to come out of my own pocket. And so that might be one of the reasons why other teachers don't do it as much. It's almost as if it's going to have to be mandated before anything is done.

Moira is also dissatisfied with the science-related professional development provided by the district. Although researchers indicate that a strong training program in science instructional methods might help teachers focus more on science by improving their content knowledge as well as their comfort level with inquiry methods of instruction (Davis, 2003; Peterson, 2002), Moira is unimpressed by what she has been offered so far. "Usually if [science] is even mentioned in an inservice, it's how do you pull science into another subject area and not have to spend a lot of time on it. It's really not allotted for . . . everyone at our campus was pretty much assigned to go to either math or writing." She continues, "Some of the teachers - they aren't strong in science because they've never been made to be strong in science. When it's not something you've been having to teach, sometimes you don't bother to get it." Without external motivation or encouragement in teacher development, science instruction in this grade level appears to boil down to one determining factor: teacher attitude.

A Third Grade Perspective: The Bottom Line

Cris likes teaching science. In fact, after twenty-nine years of teaching third and fourth grade, she just likes teaching period. Her students recognize it - their parents do, too. "She's a great teacher. I know that many of the other parents requested her for their children this year," one parent comments as we enter the school together one day. Another teacher at Lone Pine requested Cris as her gifted and talented (GT) daughter's teacher, even though Cris is not the designated GT teacher: "I know that Cris would provide all of the extended activities and individualized instruction anyway - she's just that kind of teacher." Her reputation for excellence and for her love of children is wide-

spread throughout the school and the district as well.

Her experience in education is evident when one watches Cris in action: "What is the first thing a scientist does?" she quizzes her class. "Ask questions!" the students shout out the answer. The topic of the day is matter - specifically the characteristics of solids and liquids. It should be chaos in the classroom - Cris has picked up one-third of another teacher's students when she had to go home unexpectedly with a sick child. This is probably not something a teacher wants to deal with when she's about to start a hands-on science lesson, but Cris seems unconcerned. A couple of students are doubled up in chairs and several are sitting on the floor, but all are listening and participating in the discussion. According to Cris's directions, they are going to make some observations about the "green stuff" in plastic bowls sitting beside her on the desk. Several questions are written on the board: "How does it feel?" "Why is it green?" "Where does it come from?" "How does it smell?" "Is it dangerous?" (This rather hopefully from one of the boys in the front. Cris just shakes her head.)

Quite soon there is green "slime" (a cornstarch / water mixture) *everywhere* - on their hands, their clothes, their desks, the carpet. The students are busy exploring its properties, jabbing it with their fingers, poking it with Popsicle sticks, scooping it up with plastic spoons. It's easy to see why a less hardy teacher might hesitate to tackle this particular activity, but Cris just calmly walks around the room, watching and smiling. She truly seems to revel in their excitement. "Never mind the mess," she says. "We'll clean up after you write about your experiment." They begin to write together as a group. "What were five things we learned?" she asks them. "It was gooey inside." "It

felt like a solid on top." "It was hard." "It acts like a solid and a liquid at the same time." "When it dries it becomes a powder." Each time a student suggests something, Cris ties it back into the characteristics of solids and liquids. "Can we call it a 'sliquid' ?" asks one young girl with shoulder-length brunette hair. "Not a bad idea!" Cris answers.

Despite the students' obvious love of the science activities, Cris knows they don't get enough science instruction at her grade level. "When we get to have science (you've heard that before, I know) . . . we have *allotted* [emphasis in the original] forty-five minutes per day . . . but we alternate between social studies and science. That's how the district wants us to do it." On Fridays, Cris chooses to teach art in order to give her students that experience as well. But everything takes a back seat to reading and math:

> Our pressure is reading . . . I think all of us feel like we're so pressured with the TAKS. I know the fifth grade would say, well, we have the pressure now with science, and we know that we have to start in the lower levels to do it. But then you have so much that you have to cover and you have to get that reading in, and reading for third is so important because they have to pass it to move on. And then the math is also important, so really science and social studies both kind of get put on the back burner I feel like.

Combined with this pressure to emphasize reading and math, the lack of clear mandates from the administration as far as science instruction is concerned adds another factor to the mix. Cris explains: "All we have is the scope and sequence. We're

supposed to cover it, but we have no [six-weeks] testing, no benchmark on it like we do on the reading and the math . . . I don't know how much any of us get around to teaching it, and that's the problem basically . . . There's no accountability for science."

The stress of teaching third grade, along with its "gateway" that requires students to pass the reading test at that level in order to move on to fourth grade, add to the stress of teaching this grade level, as Cris points out:

> Third and fourth grade. There's a lot of teachers that won't touch it . . . I've heard a lot of teachers say they wouldn't teach third or fourth grade either one . . . We feel the stress ourselves - not necessarily put on us from the administration. I think it's just something we feel because you see it in the newspaper all of the time. You hear that this is what the government is expecting and what the state's expecting and you just wonder, "What is the next shoe that's going to drop?"

Thus, Cris is adamant that the implementation of the fifth grade science TAKS has had no effect on the amount of time spent on science at this grade level at Lone Pine. When asked whether the science TAKS has affected science instructional methods, she also responds in the negative: "Probably not me. I think it *should*. I think it should. But probably in the way that I cover it, it probably hasn't - not until somebody comes and puts their finger on me and tells me I have to. I'm responsible for reading and math."

"How would you feel if you knew that science was something that you were going to be tested over?" I ask. "I would retire!" she firmly replies. The bottom line: There is enough "TAKS" pressure to teach reading and math right now without adding

science to the mix. . . and what gets tested gets taught.

A Fourth Grade Perspective: The Maverick

Ricki doesn't always follow the norm. A stint in the military and the pursuit of another career prior to teaching have resulted in this four-year teacher coming late to the field of education. Perhaps this is why Ricki often questions some of the district and campus directives.

> They [the district] wanted us to do three weeks of social studies, three weeks of science . . . and Mandy [another fourth grade teacher] is so good at Texas history and she loves it so much and she is wonderful at it - so knowledgeable . . . and I'm *very* excited about science . . . so we really felt that it was more beneficial for our kids for us to team and do social studies and science both each week - two days of one and two days of another . . . we felt that benefited our kids the best . . . so we're still covering all of the scope and sequence but not in quite the way they wanted us to.

Yes, Ricki has a reputation for being different - for stepping outside the mold. She is also direct and to the point, often to the point of bluntness, and pulls no punches when asked about current trends in education. Ask any fifth grade science teacher about science education in the lower grade levels and Ricki's name will come up. They all agree that her students are the best prepared as far as science is concerned when they come to fifth grade. Ricki has worked hard to achieve these results, meeting with the fifth grade teachers on her own to help determine how and what she needs to teach. She takes the initiative in other areas as well:

> I personally looked at past [TAKS] tests for science and made sure that the things I'm covering are being covered in the way and in the format for the way that it's been tested on in the past . . . and I do things like that kind of on my own . . . [last summer] I took five different things on science through Region XI [Educational Service Center] and joined the science teachers' association just to keep current with things . . . it's just a standing thing that Ms. Taylor says if I find things that I want to go do as far as science workshops or different things then just let her know and she'll try to find the funds for me to go . . . it's kind of an open policy.

When asked about the pressure she feels to teach science at the fourth grade level, Ricki replies,

> I don't feel a lot of pressure from the principal or other teachers, but I do know and am well aware that they have to take the science TAKS in the fifth grade and they have to do it in the spring and if they don't get the foundational things here and an appreciation for [science] here then they're not going to do well on the science TAKS. So I probably feel a lot more internal pressure than I do external as far as making sure the kids understand the concepts and the big ideas so that when they have to take the science TAKS they can be successful.

Despite her concern for her students' success on the fifth grade test, Ricki is adamant about her refusal to allow the test to dictate her teaching style or the amount of time she allots for science. "We have a set amount of time . . . and it's gotten the same amount of time that it's always gotten . . . I know that in the lower grades sometimes science gets kicked aside in favor of other things, but no, we have always allocated a

certain amount of time to it in our daily schedules and that's the same amount of time that we do now." She allows that perhaps the implementation of the science TAKS has helped keep her more focused. "It helps us so that we don't kind of drift around." But as far as her methods of teaching science, Ricki is very clear:

> Changing my teaching approach? No . . . I just simply refuse to totally re-do the way I do things and jump to a 'skill and drill' type of situation when I know that's not who I am - that's not how I'm most effective teaching . . . the temptation was there - I'm not going to say it wasn't, but I made up my mind that that's just not how I teach, it was not how my kids were going to be happy, and it was not how I was going to be most effective, so I refused to let it color the way I teach . . . I think if it's taught in a content-based way and you're teaching the TEKS and you're trying to teach it in a fun way, the kids don't focus so much on the test and stress so much over the test . . . they're excited about it and they're going to learn more, they're going to absorb more and they're going to be able to produce more than if we're teaching them the test. I'm teaching them the TEKS and I'm teaching them in as fun a way as I can teach them. I'm covering the content and I think that's all we can do.

Ricki, a former GT student herself, seems to thrive in this environment. The lack of strict mandates and requirements for science teaching methodology, time schedules, inservice training, and the like, allows her to branch out, take initiative, and take on a leadership role of her own.

> I've really pushed spending a lot of the money we get allocated. Before I don't

> know if that much money got spent on science - getting things we needed for the kids. I bought a lot of my own personal stuff and I try to create a lot of my own units on things . . . so I just kind of let people know what I'm doing and I try to get them excited about it, too.

Ricki's students benefit from her imagination and desire to do things a little differently. Her students find her forthright, sometimes sarcastic nature quite humorous. During the culminating activity for a unit on earth science, students were asked to create a travel brochure for a trip through the earth. This group activity was done in lieu of a paper / pencil test, and students were required to discuss the layers of the earth in their brochure as well as different types of rock and geological structures. As the students present their brochures in front of the class, it is obvious that this activity has been not only educational, but fun as well. The students are laughing at each others' presentations and spouting off information about the earth's layers and the ways in which different types of rocks are formed. They are definitely excited about science, and Ricki seems to relish their enjoyment as she laughs along with them. After discussing their vacation spot on "Lava Mountain", with its surrounding volcanoes and igneous rock, one group gives their price list to the class:

> Trip to Lava Mountain $25.00
>
> Sliding down Lava Mountain $25.00
>
> Walking on Hot Coals $25.00
>
> Catching on Fire $50.00

Catching on fire . . . Hmm. An appropriate metaphor for Ricki's science class. I

couldn't have said it better myself.

An Overview: Individualism Rules

Whether interviewing teachers at Lone Pine or having casual conversations with them in the halls, one thing quickly becomes evident. This is a school of individuals. Although the district instigated the development of scope and sequence documents for each grade level and subject last year, there is no accountability in place for science in the lower grade levels (K-4). Horizontal alignment in both curriculum and instruction is in its infant stage at this school, at least as far as science is concerned. First grade teachers are attempting to coordinate science lessons for the first time. Yet even though they intend to work together more in the spring, for the most part they are still creating and following their own lesson plans.

At the second grade level, fledgling attempts at horizontal alignment are being made as well. But, as Moira says, "we don't keep up too much with who's doing what." Especially in science, most teachers are pretty much going their own way.

According to Cris, the third grade is not much better as far as science is concerned. With so much emphasis on strategies for improvement in reading and math TAKS scores, little attention is given to science at that grade level. "I know that Sandy got lots of stuff [for science] last year. But we [the third grade teachers] haven't even had a chance to go through it and really look through that and see what's there." As she stated before, science often gets put on the back burner.

At the fourth grade level, Ricki and Mandy team together to teach social studies and science, but they are the only ones that have attempted to do so. The other fourth

grade teacher works on her own. Referring to the teacher next door, Ricki explains the situation, "She's a new teacher, and I try to give her some ideas, but she pretty much wants to do her own thing." Once again, teachers work individually, for the most part, to determine how much science - and what kind of science - gets taught in their classrooms.

Issues surrounding inservice opportunities in science are also of concern to many of the teachers at Lone Pine. Every teacher that I spoke with, whether in formal interviews or hallway conversations, discussed the lack of training in science in the district. Each one mentioned that if they were required to attend any workshops or inservice sessions, they were for math, reading, or writing. Science training was pursued on their own initiative.

Without clear direction in science from the administrative level, teachers at Lone Pine appear to have little incentive to coordinate and horizontally align their instruction or to actively pursue additional training in science education. Although the extra latitude for exploring and trying new things on their own seems perfect for teachers like Sandy, Moira, and Ricki - who thrive in that type of atmosphere - it can leave other teachers, especially new teachers and those who are less motivated (as Moira indicated earlier), more or less adrift, without guidelines or clear goals towards which to work. It can also leave teachers like Cris, pressured with the emphasis on the reading "gateway" test at third grade, with few incentives to keep a focus on science instruction in their classroom.

Contrast this school atmosphere with that of Clarksville Elementary just a few miles down the road.

CHAPTER V

CLARKSVILLE ELEMENTARY SCHOOL

Clarksville Elementary is the "new school on the block" in Atkins ISD. Built in 1998, it looks almost pristine as it sits nestled among several tall trees at the edge of a small housing district on the west side of town. As I step inside the building, the huge glassed-in office to my left occupies most of my vision. This is the domain of the principal, Gillian Dean, and her administrative staff, although one is hard-pressed to find her there much of the time. She is a roamer, moving briskly about the school - waiting with children in the parent pick-up line, escorting students onto buses, observing teachers in their classrooms, helping out in the lunchroom, or perhaps attending what she refers to as one of the "non-meetings" called by the central administration on a regular basis. Ms. Dean resents anything that takes her away from her teachers and her kids, but especially these meetings that have no agenda and no clear purpose. "They could just put everything in a memo," she claims. That would be quicker, she feels, and give her more time to do what she's supposed to do: provide support for her teachers and educate the children at her school. Clarksville Elementary has a population of kindergarten through fourth graders that is second only to Lone Pine in percentage of economically disadvantaged students (49.1%) and mobility rate (26.0%). However, Ms. Dean doesn't worry about TAKS scores and group ratings: "It's not all about the TAKS test, the TAKS results . . . I don't worry about the ratings - I worry about the kids - the individual kids - the individual."

It would be difficult to find a more widely experienced educator than Ms. Dean.

She exudes confidence and presents a picture of an individual who knows what she wants and how she wants to get it. Her attitude during her interview (and other conversations that I had with her) was very open and frank as she gave me her opinion on education in this school district, her career as a teacher, and her personal history. An English major in college, she spent four years teaching at the high school and collegiate level in Texas before moving with her husband to Libya in 1969. Referring to it as the "garden spot" of the Middle East, she enjoyed the atmosphere of teaching in that country - until September 1, 1969, and the coup that began Kadafi's regime. "Some of the teachers got cold feet and left. So the superintendent was beating on my door saying, 'I need a sixth grade teacher!' And I said, 'Sorry, I taught high school and I taught college. I wouldn't have a clue!'" However, he managed to convince her . . . and so began Ms. Dean's elementary school career. After teaching sixth grade for two years and third grade for an additional two years, she and her family moved on to Jakarta, Indonesia, where she taught sixth grade for four years:

> In Jakarta, education was wonderful - state of the art. The state department poured the money into that place. It had everything you could possibly want . . . It was K-12 and it was one-third oil company kids, one-third missionary kids, and one-third diplomats' kids. There were fifty-nine different nationalities. The embassies were pouring money into the school so we didn't lack for a thing.

She found a very different situation when her family moved on to Scotland:

> That school was run by an Englishman - it was strictly a business. He charged the oil companies tuition. The books were fifteen or twenty years old. The

> furniture was shabby. It was just the pits. Anyway, the oil companies knew they were being ripped off and knew their kids were being ripped off so they bought the Englishman out and I was on the ground level of that. I was board secretary and the board members were oil company presidents. I became what they called 'special projects coordinator,' which was to instigate the American curriculum and to hire teachers. I helped the board hire the superintendent and then I worked under the superintendent for two years . . . Then I became a counselor and was the guidance counselor for seven years . . . and high school principal for four years.

In the middle of her successful career overseas, however, she was called back to Texas when her daughter was critically injured in an automobile accident, requiring extensive - and long-term - care. A very different educational atmosphere awaited her:

> When I got here [in 1989], education had changed so much. Here in Texas, no one spoke English anymore - they all spoke, well, everything was in initials . . . I was like, what's that? What's an ARD meeting? I said there was no way I was going to go into administration, even though I was certified, until I understood what had happened to Texas education. I'd been gone twenty years from it, so I spent some time teaching sixth grade.

After five years teaching at that grade level in Atkins ISD, Ms. Dean did go on to become a high school vice-principal for four years, and finally opened Clarksville elementary as it's principal in 1998 - where she's been ever since.

Ms. Dean is a very "take-charge" kind of individual, with an authoritative and

confident attitude. Some of this could perhaps be attributed to her extensive (and wide-ranging) experience in the field of education. She has clearly defined goals and definite preferences when it comes to science education in particular:

> We should start teaching science in kindergarten - actually in pre-K . . . science is all around us and it needs to be hands-on . . . science needs to be exciting - the kids need to get their hands messy . . . I think they learn faster and I think it stays with them longer if you have hands-on . . . When I was teaching, I believed in manipulatives before they were cool! Lots and lots of hands-on - and it was fun! Now, don't get me wrong - it was noisy. But so what if it's noisy! Kids just really won't get it - they can't get it by just looking at a picture.

She has clear goals for her teachers as well. After providing them with two rooms designated solely for hands-on lab activities - one for first and second grade, one for third and fourth - she asks that they teach at least one hands-on lab activity a week. She stops short of outright mandates and directives, however. "I can dictate, but that's not going to work. You've got to have people buy in - ownership." So she prefers to lead by example; bringing science workshops to her campus on her own, as well as providing some herself:

> I showed them in a faculty meeting one time. I did pumpkins - and it was right around October - and I had all kinds of things about pumpkins: pumpkin pies, pumpkin seeds, pumpkin this, pumpkin that. But then I gave everyone their own pumpkin. And they took it and they carved it and they took the seeds out and all of that stuff, and I said, 'Now if you were a kid, which would you rather have?

> Would you rather just have the words on the overhead projector, or would you rather have the pumpkins?' And we had pumpkin pie for dessert. It was kind of dorky really, but the teachers were like, 'Oooh, oh yeah!' And I just do different things like that.

In addition to "suggestions" about teaching methods in science, Ms. Dean also requires her grade-level teachers to be horizontally aligned as far as the instruction and the TEKS are concerned. Lori, a second grade teacher at Clarksville comments: "We share our lesson plans so this year I am doing science and social studies. One other teacher does math, another does reading, another does language arts . . . there is horizontal alignment - a teamwork situation." She credits Ms. Dean for this: "She said you will come in two days [during the summer] , no pay, just, 'You're going to come in and align these TEKS. You're going to make it so that everything coordinates and we know where we're standing. And when you do your lesson plans, you will align as such.' Totally Ms. Dean's deal."

And Ms. Dean is no less adamant about participation in staff development and inservice opportunities - particularly those she brings to the campus herself.

> Having really good things that teachers can see that are fun and are really interesting. I think that's the key to the whole thing. Because you see the problem is our teachers didn't have labs when they were in elementary school. And you tend to teach the way you were taught in elementary and bless their hearts, they didn't have it . . . you've got to train teachers - you've got to make it fun for teachers. If you make it fun for teachers - when they see those kids

> getting excited - guess what? They're going to love science. There's the key right there. There's the key.

Ms. Dean strongly supports teacher training in science, and requires her teachers to participate and attend as many workshops and inservice sessions as possible - in fact she attends many of them herself, gathering materials and ideas for science activities to give out to her teachers. Ms. Dean takes an active leadership role in a variety of areas on her campus.

With this very different backdrop, when compared to Lone Pine Elementary, a less individualized approach to science education emerges from the teachers at Clarksville.

A First Grade Perspective: On a Mission

> I remember when I was in the third grade and I was called to read aloud. And I came to the word on the book - I can still see it in my mind when I see that word - and it was "immediately". And I did not know the word "immediately". And because I did not know the word my teacher therefore assumed that I did not do my homework the day before and paddled me. And I hated reading until about seven years ago. I was in my late forty's before I read a book just for enjoyment . . . before I learned the pure joy - and I almost start to cry [actually we're both teary-eyed at this point] - the pure joy that reading brings to my life and the things that I have learned over the last four or five years from just reading.

Carrie's words, and the look in her eyes as she tells her story, give me an indication of

just what kind of teacher she is. It is obvious from her attitude towards her students that she truly cares for them. At a District Leadership Team (DLT) meeting, Carrie was incensed that some of her students had been denied the school lunch after waiting in line in the cafeteria and given a cheese sandwich instead. "My babies are coming in crying after lunch. I don't care if a parent is behind on lunch money, I don't want one of my kids being denied lunch. I'll pay for it myself!" After twenty-one years of teaching (with ten years off to have her children, one of which is a "special needs" child with learning disabilities), Carrie has not lost her love for teaching, her love for her students, or her own love of learning. She has a determined attitude and a willingness to fight for what she thinks her students need, which is perhaps the reason her colleagues at Clarksville chose her as their representative on the DLT. This attitude carries over into the classroom. Faced with preparing students for TAKS tests, she is determined to teach her students more than just isolated facts. Carrie explains:

> I would hope - whether it's because of the TAKS (I would hope that's not the only reason) - I would hope as my own growth as an educator so that I don't become bored - so that I don't lose my own enthusiasm and joy of learning, and lose that ability to pass that on to [my students] - that I'm constantly trying to find new ways to teach that are fun and interesting that make students want to gain knowledge - not just pass the test.

Carrie makes no apologies for the fact that she believes the ability to read is by far the most important gift she can give her students. She feels that without these reading skills, barriers to further education will occur at all levels:

> If a child can't read he's not going to be able to do *anything* . . . he's not going to be able to do a science experiment or be able to even understand the questions being asked of him on the test. And I think especially in some areas like ours where you have children who are socially and economically deprived and don't have a lot of experiences with print, with words - no one talks to them, they have a very limited vocabulary - I think you have to spend the majority of your time on those skills. There are only so many hours in the day - there are only so many teaching hours in the day . . . you have to set priorities of the most valuable to the least - not really to say that anything's the least in any way, shape, or form - but in the whole scheme of things, which am I going to spend more time on? The barriers start falling down in first grade if they can't read.

With her strong beliefs in the importance of reading, Carrie admits that it would be easy to let science slide.

> Probably in the hierarchy of things, science and social studies are at the bottom . . . I think because the TAKS has come in, and they have raised the bar so high . . . children do have to be reading [in first grade] . . . Whether it's wrong or whether it's right, I think that things like art, music, science, and social studies will always play the part of added as 'icing to the cake'. . . so I think it's a balance of trying to keep the science in there when the focus is so much more on reading and math.

However, in Ms. Dean's school, leaving science out is not an option - regardless of the teachers' personal preferences. There is a lead science teacher for first grade (a first-

year teacher, which disqualified her as a participant for this study) who develops science lessons and schedules time in the science lab for the rest of the teachers. (The more experienced teachers at that grade level were asked to organize math and reading.) Although most teachers determine *how* they will teach the topic, the subject matter is determined by the district's scope and sequence as well as the lead teacher. With this in mind, Carrie fits science into the day by combining it with writing in the afternoon. This integrated method works well for Carrie's teaching style:

> I don't think you can isolate anything . . . I think that if you're teaching any concept, within that concept you have the opportunity to bring in many, many different facets of many, many different subject areas . . . and if you're always bringing in the things that you've learned and you're crossing over into different subject areas, then you're going to hit a lot of things. And the children are going to be well-rounded and they're going to have a good variety of things and they're not going to be lacking in a specific area . . . so I try to bring in writing [with the science] so that they can organize what information they do know and then be able to write about it so they know how to, in their own words, tell me what we just found . . . so there's about an hour and fifteen minutes of writing and science together.

Carrie feels that even more inservice opportunities (as well as the right *kind* of inservice opportunities) would help her achieve better results in science. "We've had some training, but not nearly enough." She has been very dissatisfied with the district's staff development opportunities in science, and feels that Ms. Dean is the one that should

continue to plan that training. "I don't think that someone in the hierarchy is going to help us that has never visited my classroom, never talked to me, doesn't ask my opinion." She believes that quality staff development, in addition to what she has already received at her campus, would definitely improve her science teaching.

Carrie does feel that the implementation of the science TAKS test has affected her teaching - not so much in the amount of time she spends on science, but in the fact that she teaches more hands-on science now. With the lab room designated for first and second grade, as well as Ms. Dean's encouragement, she now provides a hands-on lab activity for her students once a week. In addition, she is developing more and more science activities for her students in her classroom. As I watch her students stand next to a lamp in her classroom while they rotate slowly in place, I am amazed at how quickly they grasp the reason for night and day (not the easiest concept to teach, as those who've tried to explain it to their own six-year-old child can readily attest). By the time she finishes the lesson, Carrie has tied in the seasons, math, reading, geography, and probably several other subject areas that I didn't catch. And the students are fascinated, asking question after question that she sometimes answers and sometimes deflects: "I think one of the things that I want to get across to my students is that there's so much information that *nobody* knows it all, but you need to know where to *find* the information. And there's lots of areas from people to books to computers to maps to all different ways that they could find information . . . Teachers don't know everything and I'm learning, too . . . I'm fifty-two and I'm still learning!! I always will be . . ." Carrie's mission is seems to be to instill that same desire to "learn for a lifetime" in her students.

A Second Grade Perspective: Teaching All Children

Becky roams around the science lab, giving additional directions to her students, speaking in Spanish to some. All of the students are busy checking to see if the objects at their station sink or float in a large container of water. "Water, water, we get water!" The level of excitement is high. Each group appears to have at least one English language learner (ELL) student. These students are participating along with the rest, laughing and writing results down on their papers. None of them appear to be able to speak English, but Becky has provided them with enough instructions in Spanish to allow them to be actively involved. Becky is the only elementary bilingual teacher in the entire district. An eleven-year veteran with short blond hair and a soft, Southern accent, Becky taught bilingual first grade in west Texas for five years before moving to Atkins. After several years off to have her three children, she returned to teaching, and has taught kindergarten and second grade at Clarksville ever since. Because of her certification and experience with bilingual programs, all but one of the second-grade ELL students in the school are in her classroom. Since she has a full class, the last one had to be put with another teacher. "As soon as they reach twenty ELL students at one grade level, they will have to have a bilingual program, so that will be good. That will probably happen next year." At the time of this interview, there were thirteen ELL students in second grade in the district. There are now, two months later, twenty-three. Ms. Dean has recommended that Becky teach that program; however, according to the curriculum coordinator, the district has elected to send a request for a waiver to the state, postponing implementation of the bilingual program for another year. Nevertheless,

Becky is determined to provide a quality education for all of her students *this* year, regardless of their English language skills.

Watching her discuss the lab with her students, I am impressed by the way she seamlessly works in Spanish translations for the terminology, drawing the ELL students into the discussion (although the most I've seen them do so far is shake or nod their heads - speaking in front of the class appears to create a bit too much anxiety on their part). Regardless, the students seem to be adjusting to the situation readily (if their participation in this lab, as well as their smiles and laughter, are any indication) thanks to Becky's experience in working with ELL students. (I can't help wondering if the ELL student in the other teacher's classroom is faring as well.)

As with all of her students, Becky is concerned about the TAKS test for her ELL students. They are allowed only two years to acquire proficiency in English before they will be required to take the TAKS in English. "We're trying so hard to get their reading up to par so that they *can* learn on their." This is true for the regular and ELL students alike. Becky is especially fond of hands-on experiences in science, attributing the greater emphasis on these types of activities to the implementation of the science TAKS test. "I think it's good changes. I think we're getting more hands-on - a lot more hands-on now, and I think that's good. I have a lot of ELL students - it's a wonderful way for them to learn English as well as the concepts we're getting across, so I think we're getting better at it." However, Becky still feels strongly about where her emphasis must lie.

I think if you're struggling to survive - and I feel that reading is a survival thing -

> at this level we're still struggling so much to teach reading that it's really easy to put aside science and leave it and take the extra time and kind of make it go away . . . I would say it's just a triage thing. You have to pick the neediest and go with that first.

She credits Ms. Dean for keeping her, and the rest of school, focused on providing quality science education in spite of the "TAKS" pressure to teach reading and math:

> It was Ms. Dean that applied the pressure to have the science lab - she provided the space for that and the materials and made that a high priority for Clarksville Elementary. And so that's why, if we had not had that from up above, we would not have had the nice equipment and things that we do . . . And she sat down with us at one time - the lead teachers. She wanted to see our schedules for the science lab and made sure that it's understood that when we go into there it's hands-on experiments.

She also appreciates the driving force that Ms. Dean provides to ensure the school's vertical and horizontal alignment.

> We were "exemplary" a couple of years ago and that's just a real kick and makes you feel like the teamwork is there and everything . . . and I know Ms. Dean has mentioned before about talking with the people from Harrison [the fifth and sixth grade campus] and finding out what we need to strengthen . . . asking, 'OK, what do we need to work on?' and following through on that. I think it does help.

Staff development is another strong point for Ms. Dean, as far as Becky is concerned. "We had a science workshop that was actually during our summer. We did that because we knew that it was going to be really good. Ms. Dean arranged to have them. Other than that I can't think of any other ones I've been to in this school district - maybe one at the service center." When asked if she was required to attend, Becky replies, "Pretty much . . . it was just understood . . ." She feels that the encouragement and leadership provided by Ms. Dean has helped her to teach science to *all* of her students more effectively.

A Third Grade Perspective: Teamwork

Helen is a team player. Anyone who knows her would agree. The principal, Ms. Dean, is well aware of Helen's willingness to do whatever is best for the students at Clarksville Elementary. Tall and slender, with short-cropped, reddish-brown hair, Helen's looks belie the fact that she has two grown daughters with children of their own. With only her husband and herself at home now, she finds even more time to focus on her young students. Yet when Ms. Dean first asked Helen to move from second grade (where she had been teaching for nineteen years) to the third grade in order to help improve instruction for that important "gateway" year, Helen's first response was an immediate, "No!" Helen continues: "I was about ready to retire, there was no need for me to change grades - I've been teaching second grade all of this time." But Ms. Dean wouldn't take no for an answer, asking Helen to think about it first and then get back to her. "I started thinking about the teachers I'd be working with. I'd been teaching second grade and getting these kids ready for the TAKS all of this time, and I thought,

'Hey, I can do this!'" So she agreed, and jumped right into the middle of that third grade atmosphere with a clear vision of what she wanted to accomplish with the students. Two years later and multiple TAKS tests behind her, Helen adds a bit ruefully, "Little did I know that getting the kids *ready* for the TAKS test is very different from *giving* it . . ." The pressure on third grade teachers can be daunting at times:

> I think there's more pressure put on us with the TAKS . . . It's hard because we're focusing so much on the reading and the math. They *have* to pass the reading, and you want them to pass the math, too, because it comes back and reflects on you . . . it's been even harder this year because these third graders have come in and we felt that they were behind and we're going to have to do a lot more getting them ready with the basic skills . . . We just want to do the best we can do.

Feeling this pressure, Helen, is tempted at times to let science slide. "Yes, it's very tempting to put it in the background . . . because we're focusing more on math and reading." However, strong horizontal curriculum and instructional alignment among the third grade teachers at Clarksville has helped to keep science in focus, with different teachers responsible for different subjects. Within this system, Helen heads up math and science, which requires her to develop and set up the science activities. She is the first to admit that Ms. Dean has been much of the driving force behind her increased efforts in science education.

> Ms. Dean paid bunches of money . . . to send Chloe [a fourth grade teacher] and myself to the national science conference in Dallas. That was just awesome.

> Just the fact that she would send us over there for those days and then to pay our membership and for her to take the money to find the subs to send us . . . she's very supportive - she doesn't do (and I think she gets reprimanded) - she doesn't do the conferences and go to the principal's conventions. She goes on line or goes to the Service Center to get her training and uses that money for the teachers to go to the ones that we feel that we need to . . . She's out there willing to pay the money and find the money for us to go to the conferences and the workshops - and anything that we see that will benefit us that we want to go to - she finds a way for us to go.

Helen steps in a long line of teachers praising Ms. Dean for her work in developing the labs for Clarksville: "I know that Ms. Dean has really worked long and hard to try to get money for our science lab . . . and we're really excited . . . so she expects us to be doing labs." Helen agrees with Ms. Dean: "The kids learn so much more from doing hands-on than from doing paper-work . . . I think they retain the information more because they're actually experimenting and using their hands . . . and it just helps when the principal is right behind us getting us the materials we need."

Ms. Dean claims that she is not above encouraging a little competitive spirit among her teachers in order to help achieve her goals. With the help of one of the fifth grade science teachers at Harrison, Ms. Dean analyzed the science TAKS results for the students from Clarksville Elementary, Lone Pine Elementary, and a third elementary school that sends a portion of its students to Harrison. According to Helen, "Ms. Dean came back with the report that helped us to see that we really needed to focus more on

science . . . Clarksville wasn't doing as good as we wanted it to be . . . We really didn't like being on the bottom!" With these results fresh in her teachers' minds, Ms. Dean then asked them to analyze the science questions on the TAKS. Helen appreciates that strategy: "We took a lot of time taking the fifth grade science TAKS test and seeing how many of the objectives we're responsible for [at each grade level] . . . knowing what [the students] have to do makes a difference."

Helen sees the science TAKS as having a positive influence on elementary science education in general: "I think that with the TAKS test in science that there's more emphasis on science and it's forcing us to teach it more than what we were teaching it - we're having to focus more on it than we have before - certain TEKS that we have to teach to get them ready for TAKS, to take the test. So I think there's more time in science because of the TAKS test." However, without Ms. Dean's encouragement, Helen believes the implementation of the science TAKS would have had less effect. "If it weren't for Ms. Dean, I don't know that I would have taken those fifth grade science TAKS tests and looked at them . . . Ms. Dean expects us, she has told us, that it doesn't just start in second or third grade - it starts in kindergarten . . . she wants us to do good."

Ms. Dean fosters teamwork at Clarksville Elementary. Helen appreciate that atmosphere, and credits her principal for creating it and for working as hard as she can to make her job just a little bit easier. "Ms. Dean is so strong. She used to be a teacher and she remembers . . ."

A Fourth Grade Perspective - Struggling for Balance

"Who are you?"

"What are you writing?"

"Are you the sub?"

Chloe's students can't keep from asking me questions as they wait for her to check off their assignment sheets before the lab, and I can't help laughing. I appreciate their curiosity (it's not a bad quality for nine-year-old fledgling scientists to have). These students are active and lively. Several are hopping in their seats with their hands raised, begging to carry the crate to the lab (evidently a job of some importance). Chad is ecstatic when he is chosen as the crate carrier and Bronson is equally happy to be picked as class monitor. As they trip along to the lab down the hall, entering the room with barely contained excitement, Chloe – not much taller than her students - leads the way. She is a match for them. Dynamic and energetic, rarely completing a sentence when she's excited, Chloe's enthusiasm is as evident as that of her students.

She begins the lab with questions about fossils, types of rock, dissolving, weathering, and erosion. The students are vying with each other for the opportunity to answer - they seem quite knowledgeable about the vocabulary. Today they are going to apply that vocabulary, participating in a hands-on activity to demonstrate the formation of a fossil. Chloe has spent a great deal of time preparing for the lab, gluing sugar cubes together in clumps to represent fossils (sugar to represent tissue, glue to represent bones). Warm water will act as the process of "weathering" in this model. The students can't wait to get started (what is it about water and small children?). Only one student, Ethan,

seems unhappy - he does NOT want to sit by Marcus. "Ethan, you have a choice to stay with us or a choice to leave," Chloe calmly states. Ethan glumly returns to his seat, head hanging. (Evidently he would rather sit by Marcus than miss the lab.) Students at each lab table place their sugar/glue "fossil" in a strainer, hold it over a large bowl, and begin to pour warm water over the top. As the sugar "tissue" starts to dissolve, leaving the glue "bones" behind, student comments can be heard around the room (which is now a little soggy in spots):

"Wow, look at the sugar melting away!" "It's not melting, it's *dissolving*!" "Whatever."

"Ooh look at the glue in the bottom - is that what it looks like?" "Is that supposed to be bone?" "Yeah, *dinosaur* bones!" "Cool!"

"Can we keep the glue part?" Chloe laughs and agrees that they can put the glue on paper towels to dry and take them home later. (Dried glue and dissected lima beans are evidently hot commodities among young science students.)

Chloe wishes that they could have made the "fossils" themselves, but there just wasn't time. It would have taken away from math - a TAKS-tested subject.

> It's just hard . . . because I'm responsible for every fourth grader on the math TAKS test (I'm the only one teaching math and science at the fourth grade). So I've got to get all of those fourth graders to pass the math TAKS . . . If I have to look at where I need to focus if I am short on time, it's going to be math . . . Right now we're doing the majority math and our science is being squashed. Once we get past that TAKS test [in April], we're going to go to majority science,

> and math is going to be scrunched . . . It's like with social studies. Do we short-change social studies? Probably. Because we - and this is a result of the fifth grade science TAKS test - if I'm going to short-change science or social studies, I'm going to short-change social studies.

This constant balancing act between the subject areas has puts a strain on the amount of time she spends on science instruction. Chloe, a former nurse - and a teacher for the past five years - has always made time for science, which she loves. However, Chloe does feel the pressure to emphasize math. So she is teaching science in different ways than she has in previous years:

> That's a result of the TAKS test . . . in third and fourth grade it kind of drives everything . . . we were doing some things that I don't think were going to help the fifth grade TAKS and we got rid of some of that stuff. We had a teacher that was really into building space labs. And you know, the kids worked on it, there were some good things that came out of it, but that had nothing in the TEKS that would transfer to the TAKS. So we got rid of that.

What they have now, Chloe feels, is a more TEKS-based, hands-on approach to teaching science.

> We've really focused a lot on models and different types of models. We try to teach them the scientific process and we go through that every single time - what is the problem, what is the hypothesis and what's our procedure . . . they haven't had a lot of experience with the multiple choice and all of that but they've had the actual [hands-on] experience.

There's simply not enough time for both:

> We're not cutting out really any of the hands-on experience. We're cutting out a lot of the time when we really read a lot of the text instead of just summarizing it. We're cutting out - we're not doing a lot of the written. They're still experiencing the hands-on, but they're not having the time to write the detailed stuff about it.

When I ask how she feels about leaving out the written activities, Chloe admits that she worries that perhaps she's tipping the balance a bit heavily in favor of hands-on activities - yet she sees no other alternative considering the amount of time she must spend on math.

Chloe does feel that Ms. Dean's support in sending her to the national science conference and providing her with the opportunity to attend a wide variety of science workshops has helped tremendously by enhancing her ability to balance science instruction more effectively with math. More integration of the two subjects has definitely helped with the time crunch.

As another tactic for improving science instruction, Chloe also appreciates Ms. Dean's strategy of looking at former Clarksville students' performance on the fifth grade science TAKS: "We weren't the best in science, and I think that had a lot of effect . . . It made us go back and look at what we're doing in covering things . . . how we're teaching it." Chloe joins the other teachers in praising Ms. Dean for her support of science instruction. "We've got a really good science lab - supply-wise, we are probably the best in the district . . . [Ms. Dean] put money into the science lab - and she wants us

to use the science lab and she wants to make sure that's done . . . [Ms. Dean] said, 'They can't get it if they don't do hands-on.'"

With these hands-on techniques, Chloe hopes she can just teach her students to be able to think - to problem-solve. If they can do that, then Chloe feels the science TAKS test will be no problem for them.

> I don't think they can memorize everything from second grade on up that they're going to be tested on, but if those kids can think . . . Basically, we try to teach them that science is questions. They need to keep asking questions - and those questions should lead to other questions. I think we need a whole new core subject - how to think . . . I can't know every question possible out there that they can answer. But if they can think, then maybe they'll be able figure it out.

She feels that improving their problem-solving skills will definitely tip the scales in her students' favor, regardless of the subject matter - a worthwhile goal, according to Chloe. Teaching and learning in a TAKS-driven environment is definitely a balancing act.

An Overview: Teamwork Rules

Ms. Dean runs a tight ship. Each grade level in her school has horizontally and vertically aligned curriculum. At some grade levels, science instruction is aligned as well. Under her leadership, the teachers are required to attend workshops, furthering their training in science education. Ms. Dean has also provided two lab rooms to encourage hands-on instructional methods in science. Although she doesn't hand down strict mandates and edicts, Ms. Dean's teachers all know what she expects: teach hands-on and follow the TEKS. As Ms. Dean claims,

> Curriculum is where it's all at. If we'll just get the TEKS - get your curriculum in line and try to make learning fun . . . you've got to have the [TAKS] formatted questions, but you don't have to overkill. You don't have to drill and kill them, you don't have to have worksheet after worksheet after worksheet. You know, that's crazy! You can teach kids so much - I think they learn faster and I think it stays with them longer if you have hands-on. I just know it does.

Ms. Dean knows how to create an atmosphere of cohesiveness in science instruction among her teachers: grade-level meetings, co-operative lesson plans, a little competition with other elementary schools . . . and strong leadership. Every teacher that I spoke with, whether an "official" participant in this study or not, appreciates those qualities in their principal - even when it means extra work "off the clock". "She makes us want to do a better job - to be the best we can be," Chloe comments as we walk down the hall. Helen sums it up: "It's all about teamwork."

CHAPTER VI

HARRISON MIDDLE SCHOOL

Harrison Middle School is perhaps the most picturesque school in the district. Nestled in the midst of large oak trees, it lies on the outskirts of town, the lone man-made structure occupying its section of the countryside. Built in 1993, Harrison houses half of the fifth and sixth grade population of Atkins ISD. Both Lone Pine and Clarksville feed this school, as does a third elementary school down the road, although only a portion of the students from this school come to Harrison. With a mobility rate of 26.9% and a student body that is 41.9% economically disadvantaged, Harrison has a demographic profile similar to both Lone Pine and Clarksville.

Barbara Kildare, a graduate of Texas Women's University, serves as principal at Harrison. She has a friendly, effervescent personality and a pronounced Southern accent. Following a seventeen-year teaching career (encompassing all grade levels, kindergarten through eighth), Ms. Kildare has been an administrator for eleven years - five years at a junior high school, six years at Harrison. She likes the variety that comes from being in this position:

> It's never the same. It's always different. You can plan to sit down and do paperwork or get some things accomplished and that just might not happen. All of a sudden you've got either the student that's down in the behavior classroom having some problems, or a parent just shows up, or a teacher needs some help . . . Every day is different as an administrator.

The fifth grade at Harrison Middle School operates within a semi-

departmentalized class structure, with language arts, math, and science (the TAKS-tested subjects) receiving the longest time blocks. Of all of the elementary and middle schools in the district, Harrison has the best reputation as far as science education is concerned - a reputation that began well before the implementation of the science TAKS. "We were the first of the fifth and sixth grade schools to have a science lab [nine years ago]. Theresa [the science lab teacher at Harrison] has pulled them out one day a week for science lab for that many years."

Throughout the interview, Ms. Kildare seems to carefully concentrate on making everything she says very "politically correct." However, she does appear to speak candidly about science instruction at her school. When asked about the effects of the implementation of the science TAKS at the fifth grade level, Ms. Kildare replies,

> It's made us do more . . . especially in fifth grade. . . . There's three tests in the fifth grade: math, science, and reading. They have to pass the reading and math in order to go to the sixth grade. They take the science; however, it's not mandatory that they pass that test. But we divided [the teachers] into teams of three so that each teacher is responsible for a certain TAKS exam . . . We lump language arts and social studies together. Math and science stand alone . . . Before we were looking at maybe thirty minutes a day [of science instruction] . . . Now they're in their classes about eighty minutes a day.

At the fifth grade level, the decision to teach science is not optional. It is a tested subject. Yet even so, the fact that the students are not required to pass science in order to go on to the sixth grade influences the emphasis placed on science instruction:

> As far as tutorials and stuff we pretty much tutor in math and reading - we don't do the extra in science as much. It makes a difference when you don't have to pass it. BUT two years ago I would have said we don't do nearly enough for science. But within the past two years I believe that we've done quite a bit . . . we're making some gains. We've all been on that learning curve.

According to Ms. Kildare, the regular classroom science teachers have stepped up to the plate as well, changing their methods of instruction by increasing the hands-on science activities in their own classrooms.

> There's more hands-on. Because before [the science TAKS], it was just in the science lab one day a week. Now I believe it's implemented throughout their science lessons . . . They're implementing more and more in their regular classroom and doing more hands-on . . . and I like to see more hands-on. I like to see them not just doing it out of the book, doing a lecture, and answering questions . . . The hands-on component is really important, because if they can see it and feel it, they can sometimes remember it. That's what we hope!

Ms. Kildare also stresses that the teachers have stepped up the amount of TAKS-formatted written work that the students do. After the central administration implemented a district-wide, TAKS-formatted, six-weeks assessment last year, the teachers at Harrison decided to take it a step further. Ms. Kildare explains: "With what we've done with our scope and sequence and the six-weeks tests last year, we decided to start requiring our weekly tests to be in TAKS format with the questions, so they're seeing these types of questions where they're having to read and know what they're

looking for." Some teachers, however, are tempted to carry the paper/pencil tasks a bit too far, Ms. Kildare believes: "You just have to watch them. Pull the book away from them. In fact there's one that if we would let her that's all she'd do - here let's read the chapter, let's do the questions. And if that were acceptable, that would be the way she would teach."

But for Ms. Kildare, that is not acceptable. Although she does not appear to have the same degree of control as that exhibited by Ms. Dean, Ms. Kildare expects her teachers to teach to a certain standard. Science is a tested subject, after all, as she will readily admit. "We think about it all the time. You just can't help it." To that end, she encourages the teachers to attend extra workshops and staff development to improve their science teaching methods, although she leaves decisions about attendance at these inservices up to the teachers. "We're just always looking at things that they can find to enhance our skills." The pressure to have improved TAKS scores in science, as well as the greater emphasis at all levels on reading and math, drive many of the decisions that Ms. Kildare makes concerning science instruction at Harrison.

In this very different, TAKS-tested grade level, science teaching takes on a whole new dimension.

Theresa: The Driving Force

As I walk into Theresa's lab at Harrison Middle School, the first thing I notice are the shelves that line one entire wall of the classroom. Row upon row of boxes labeled "timers", "sockets", "light bulbs", "tuning forks", "motors", "spring scales" - and more - reach up toward the ceiling. Terrariums full of plants sit under the windows,

and several aquariums softly bubble in the background. Balances, graduated cylinders, beakers, and flasks all stack side by side against another wall. Each box and each piece of equipment advertises the purpose of this room: to provide a space for hands-on, minds-on, learning experiences for the students at Harrison.

Theresa, a fifteen-year veteran teacher, started the lab science class here nine years ago - several years before science became a TAKS-tested subject. Convincing the principal at that time of the importance of frequent hands-on experiences for all of the students at Harrison, she began the program - the first of its kind in the Atkins school district. Theresa is the lab science teacher. All students in both fifth and sixth grades come to her for hands-on laboratory experiences once each week.

In the classroom, she is organized and well-prepared. Her students know where to sit, where to get materials, and what to do with them. Today they are birds, using different "beaks" (plastic forks, spoon, and knives) to gather "food" (small beans and macaroni). With this activity, the students will learn about natural selection. Listening to their comments, the lab appears to be a success – the students are learning and enjoying themselves at the same time. They chatter excitedly as they busily write down results on their report sheets and in their journals.

Until the science TAKS test was implemented, Theresa admits that the time spent on science in the regular classroom was sporadic at best: "Science was just if we get to it . . . At one time, for several years that I was here, the fifth grade was all self-contained and it was pretty much reading and math and get to science if you could. So I know [the TAKS test] has changed the emphasis on science."

Now, with sixty to eighty minutes of science daily, including Theresa's lab period each week, it is easy to see the greater importance science has as a tested subject. "We emphasize it pretty strongly here, and I think that our test scores this year will show it . . . The TAKS test definitely drives us," Theresa affirms. Science is so important at the fifth grade level that last year, for six weeks prior to the TAKS test, the principal suspended lab for the sixth grade so that more attention could be given to the fifth-graders. The emphasis on science in the sixth grade is not as heavy. Taught every other day, it alternates with social studies - after all, as Theresa claims, it is not a tested subject at that level. "And it does concern me that they're not getting as much [science] as they need in the sixth grade . . . there's still a lot to learn between the sixth grade and the eighth grade TAKS test. It's going to get a lot more complex before they take that test. I'm not sure that the every other day thing is best."

Theresa feels that the implementation of the science TAKS has also influenced science instructional methods in the fifth grade - at least for most science teachers at Harrison. "I know they are doing more hands-on science in the regular classroom . . . at least another demonstration, and sometimes the kids are involved in things, too, once a week." The science teachers at Harrison are also working together more closely since the implementation of the test. In previous years, the topics covered in Theresa's lab class might be very different from those being covered in the regular classroom. However, that has changed.

> We work together as colleagues. Now I let them plan the lessons as far as how they want to do it. And then they let me know what they're doing that week and

> I plan the labs that go with it . . . I just kind of let them use their stuff and I just draw on the things I learned from college and in my Master's classes . . . There's just some things that are easier to do in here rather than them having to do all of the set-up.

There are some topics that are a bit more difficult to find lab experiences for, however, especially in space science: "It's a little hard to do hands-on 'sun'!" Theresa laughs. She does try to help out the classroom teachers as much as possible, though, aligning the topics covered in the lab and the classroom as much as possible, giving them ideas for hands-on experiences to use on their own - whatever it takes to increase these types of activities for the students.

Yet despite the improvement in many areas of science instruction at Harrison, she feels that not all of the changes have been positive: "They do more hands-on, but they do a lot of 'drill and kill' paperwork, too. I know that last year there was a lot of 'drill and kill' paper work - TAKS-formatted questions, that type of thing." The lack of depth in coverage of many of the science topics they study also concerns Theresa: "You can't get too in-depth with anything anymore because you've got so much ground to cover. And I don't like that." In the past, students would set up miniature ecosystems themselves in class, but now they are fortunate if they see one as a demonstration. Other in-depth labs have been dropped as well. "It does bother me . . . You can't spend too much time on anything."

And it's not that she feels pressured by either her principal or the central administration to teach more topics in science or to teach it in different ways. "I don't

feel any push . . . not so much in science. In fact, ever since Mr. Edwards [the superintendent] got here, I have felt less pressure." As with the lower grade levels, reading and math still take precedence in the middle school. Reading must be passed at the fifth grade level in order for the student to move up to the sixth grade. In addition, math is added at this level as a "must-pass" test for promotion. "Ms. Kildare was pushing pretty hard last year with the reading and math . . . the teachers felt the pressure. Not that she was ugly or anything, but she was under pressure and you have to transfer the pressure somewhere!" She continues, "Ms. Kildare kind of leaves the science to us. We were improving every year so I think that was acceptable to her that we were doing better . . . They want us to have good TAKS scores, but as far as leading us to get there, well . . . " she trails off. Evidently the scores on the science TAKS are considered a strong enough accountability system for students and teachers alike, without the addition of local mandates and directives. Whether overtly stated or not, however, the teachers know what is expected - keep the scores up. The scores at Harrison have shown improvement since the implementation of the test. In 2003, 63 % of the fifth graders met the standards on the science TAKS. Although this percentage fell to 55 % passing in 2004, the scores rose to 76 % passing in 2005 - enough to help push them into the "recognized" category for that year.

On the other hand, the lack of clear administrative direction in the area of science apparently leads to very different practices in the regular classroom, particularly in the light of the pressure to achieve higher test scores. From the use of frequent hands-on experiences, to the use of primarily demonstration/observation activities, to a focus on

more “drill and kill” paper/pencil tasks - each of these practices can be found in the regular science classroom at Harrison.

Josie: The Best Practice

Ten-year-old Brad, wearing a bright yellow shirt, perches on top of his desk at the front of the room, grinning broadly. He is the sun. The rest of the students stand on the floor with their arms in the air, leaning, leaning, leaning as far as they can towards Brad. A few topple over (whether by accident or design), and all are giggling and laughing along with their teacher, Josie. Petite, with long blonde hair, this mother of three young children is in the middle of a lesson on *phototropism,* and the students are pretending to be plants as they grow towards the sun. Brad returns to his seat and the rest of the students sit down as well. They have enjoyed the short respite and now return to reading the textbook aloud, a group at a time. The rest of the lesson will be occupied by making vocabulary cards for spelling, and coloring and labeling a picture of a flower. This brief nod towards a hands-on experience is effective. The students appear to have a good grasp of the concept of phototropism, and they enjoy the activity. However, the heavier emphasis on the text and the paper / pencil activities seems to be the routine for the class, based on Josie’s lesson plans.

Although Josie (who has taught mostly math and science to fifth and sixth graders for the past thirteen years) claims to teach hands-on activities about one quarter of the class time, her lesson plans do not support this. In the two-week “window” for observing her class, this was the only time she reports doing any student activities. On the windowsill I see a miniature “ecosystem” in a two-liter bottle, a “chia pet” - grass

sprouting from dirt wrapped in pantyhose, and a bean sprout growing in a styrofoam cup. However, these appear to be demonstrations for the class to observe rather than individual projects. Josie confirms this. "We just don't have the time to do it individually." Josie is the only fifth grade science teacher that also teaches math. Unlike the other teachers, who work three to a team (language arts and social studies combined, with math and science as separate subjects), Josie works in a team of two. This results in a sixty-minute period for her science classes rather than the eighty minutes allotted to the other science teachers. Although she complains about the lack of time to cover the material required in the district's scope and sequence for the six weeks, other teachers at the school mention that her team chose to give the students a thirty-minute study hall at the end of the day - something these teachers chose not to do. "We just didn't think that would be the most beneficial situation for our students," one teacher stated.

Yet despite the shorter science period compared to the rest of her colleagues in the fifth grade, Josie claims that the implementation of the science TAKS has resulted in a two-fold increase in the amount of time spent on science, especially since the school decided to departmentalize rather than teach in self-contained classrooms. In addition, more time is spent on science at the fifth grade level than at the sixth grade. "I taught sixth-grade science last year . . . and I taught it forty-five minutes." This is less than half the time allotted for the fifth grade. The reason is simple: "It wasn't tested," she explains. Without a test looming overhead, science often receives less attention in sixth grade. On the other hand, science at the fifth grade level can sometimes be pushed aside

as well.

> They have to pass the math and reading to go on to sixth grade. They don't have to pass the fifth grade science to go on to sixth grade. I think it has a lot to do with it . . . We were tutoring, pulling them out of PE and music, computer . . . even the science teachers helped tutor math and reading, and there was no time ever for science . . . And that's a double-edged sword for me because I'm doing both. My outlook on both of those is, I'll do the best I can with the science, but they have to have the math to pass. I think it's an injustice for science, ideally. But realistically, what can you do? You have to do what you can do.

Once again, the bottom line with a twist: What gets tested gets taught . . . but what has to be passed for promotion gets taught more.

Although Josie is convinced that science is being taught more often, she does have concerns about the changes in instructional methods that have occurred since the implementation of the TAKS. She feels that, percentage-wise, she teaches fewer hands-on activities and spends more time on review.

> I feel like I do less . . . I know the best way to teach science is through experimenting and doing it hands-on . . . but just trying to get the content there - the background knowledge . . . we're doing different things in class - going over all the objectives, starting earlier in the year to sit back and review what they did in the Fall to keep it fresh and retain what they've learned.

She is also concerned about the "mile wide - inch deep" curriculum focus in science:

> "I feel like I'm much more pressured to get more in in a smaller amount of time

> and more content in. And right now I often feel that I'm not doing it justice - just because I know in the past I may have done a really good job teaching certain units - and we spent enough time on it so that I know the kids fully understood - but did those things and didn't necessarily finish everything as far as the content. Maybe I didn't get to everything (I think it was astronomy that was at the end so I didn't get to the space unit necessarily). But now since it's all tested, in order to get it all in, I feel like I rush through . . . and I'm supposed to have covered it all before the test [in April, over a month before the end of school].

According to Josie, the pressure to cover all of the objectives and increase the TAKS scores in science has influenced her style of teaching, pushing her to focus more on demonstrations and observation rather than individual hands-on experiences - as well as to introduce more paper / pencil tasks. She feels that this is the best practice for her classroom in order for her students to do well on the TAKS.

Carla: From a Distance

As I step into Carla's room, I see several students working quietly on the "question of the day," a TAKS-formatted question projected on a screen at the front of the room. I sit down and peer at it, squinting my eyes to see, but I still fail to make out many of the words - they're simply too tiny. I wonder how well the students are doing. I look around, noticing that many don't seem to be trying at all - they're shuffling through papers, whispering to neighbors, tying a recalcitrant shoelace. Carla gets up, standing near the screen, and begins the classroom discussion. Austin, a young boy in the middle of the room, volunteers to answer the question. He gets it wrong. Carla

moves on to a small girl who answers the question correctly. Austin raises his hand again, insisting that his answer is correct as well (actually, I agree with him - both answers could work for this question). Carla insists that the answer key does not list his choice as correct, therefore he must be wrong. Austin slumps in his seat. She quickly moves on to the next activity.

They will be doing a selection from a TAKS-formatted packet today. There is a two-page passage to read dealing with observations and symmetry, with several multiple-choice questions at the end. "You know, it's one of those packets that you love to do," Carla tells the students. "No we don't!" comes the chorus from several in the class. "Do we have to do the whole thing?" one boy asks. "Did you say you wanted to do another?" she counters. He doesn't say another word.

As they begin to discuss observations and symmetry, Carla shows the students a picture of a starfish. "How many lines of symmetry are there in a starfish?" she asks. "Five!" says Austin, hand in the air. "No," Carla says. She turns to another student. "Five!" Austin calls again. "It's not five," Carla sighs. "It's five, it's five!" Austin insists. "It's not five, it's one," Carla tells him. "I know it's five!" Austin says, frustrated now. "The answer key says one," Carla is adamant, "That's the right answer." Once again, Austin slumps in his seat, resting his chin in his hand. I begin to wonder about this "answer key", for Austin is correct - there are five lines of symmetry in the picture of the starfish.

As Carla finishes the lesson, she informs her students, "We don't have any more tests this week. Next week we'll be studying the nitrogen and water cycles." Once more

from Austin, “We did the nitrogen cycle and the water cycle in the fourth grade!” He won’t seem to give up. “Well,” Carla replies, “now you’ll really learn it because you’ll be tested over it.” This time Austin lays his head on his desk.

Carla has been teaching mostly math and science to fifth graders for the past eight years. She has a stall, sturdy frame, with short-cropped hair and a voice that carries clearly across the room. Her class has a different atmosphere from the other classes I have observed. The students seem almost lethargic as they go about their assignments, some glancing around the room, their eyes on everything except their papers. Others tap pencils or twist in their chairs. Few seem interested in the work. According to Carla (and supported by her lesson plans), today’s eighty-minute lesson typifies the normal range of activities in her class: reading the textbook (“I read out of our textbook . . . I read everything orally to them . . . because I don’t like to have them read it themselves because science words are hard for them to understand”); worksheets over the vocabulary (“if they don’t know what the terms mean then they can’t do well on the science TAKS test”); and lecture notes over the material (“the notes are exactly what’s on the test and you know we review those notes, we go over those notes, we talk about those notes”). If the material in the textbook is too complicated or difficult, Carla uses a TAKS practice packet with short articles and related questions - often three or four (or more) of them a week. Every Friday, the students are then given a test in TAKS format - multiple choice questions over the material covered for the week.

This leaves little room for hands-on instruction, other than the lessons in Theresa’s classroom one day each week. Carla defends the lack of these types of

activities in her classes:

> To me in the fifth grade it's kind of hard to do a lot of the hands-on stuff, but they're wanting to always push the hands-on stuff, and some of the kids at this level . . . this year are not good at hands-on. There's a lot of work at doing hands-on. But they're of course wanting to do more hands-on, and the problem I have with some of that is that they do the hands-on, but they don't understand why they're doing it.

If she does a hands-on activity, Carla limits the amount of time. "I don't like them to get too much . . . I would say thirty minutes . . . If it's too much they can't handle it. They get off-track and they're out of their seats. They're going to tend to walk and talk and run around and a little bit more not focused on what they're doing."

She does agree that the implementation of the science TAKS has increased the amount of time and emphasis put on science in the fifth grade.

> I talk about it more than I used to - put more emphasis on certain aspects that I know are important . . . because when I taught math, science, and social studies and science wasn't tested, sure I put more of my emphasis on the math part of it than I did the science and social studies . . . and when I taught just science and social studies last year . . . I mean [science] was more what I focused on. I just made sure I at least tried to hit some of the TEKS on the social studies. But on the science I made sure every one of those TEKS was covered - and that I'd covered them more thoroughly.

In addition, she feels that the implementation of the science TAKS has changed the way

that she teaches science as well: "I do a lot more repeated review . . . We do a [TAKS] question a day in the morning . . . our tests are done in TAKS format - multiple choice questions . . . I think I do much better than what I did."

Carla feels that additional staff development would improve her teaching skills. However, she hasn't felt that the training offered by the district has been satisfactory. In addition, there is no real push to attend science workshops outside the district. Without that incentive, Carla makes little effort to obtain more training: "I haven't got to go to a lot of them . . . I'm not one that spends my whole summer going to conferences. If you can get four days out of me during the summer, that's good." Yet more frequent staff development in inquiry methods of science instruction might help Carla to supplement the book work in her class with other types of activities (Peterson, 2002). She is convinced of this, herself: "Inservice does help. It lets you see things differently and be able to take some things back to class. They do more with hands-on stuff. I don't do really well at hands-on and it gets me to do more . . . it's just taken me a while to get into it and try to figure out what to do and to be familiar with it and try to get the kids a little more interested in what we're trying to do."

In the absence of more varied activities, the regimented routines and the focus on paper/pencil tasks seem to result in a teaching style that appears somewhat distanced from her students, creating a rather impersonal atmosphere in Carla's classroom. Carla's attitude towards her students adds to this picture:

> I don't get, well, involved with my students. It doesn't matter to me where they come from, what school they come from, what their background is. And I really

> don't want to know a lot about their background, because there's not a lot I can do as a teacher. I can't take these kids home, I can't take them home and feed them. I can't bring them all clothes, I can't give them lunch money . . . I mean, as a teacher you try, but they come to school not clean, no pencil, no paper - not anything.

Although Carla mentions several times that she wants her students to do well and to score well on the TAKS, the impersonal, distanced environment in her classroom does not appear to promote the students' interest in learning new concepts or their appreciation of science.

Contrast Carla's classroom with that of Katie, another science teacher down the hall.

Katie: The Making of a Science Teacher

Katie's students toss comments back and forth as they go over the "question of the day" projected on the screen at the front of the class. Several of the students are convinced that there are two possible correct answers for the question. (I agree.) Katie fields their comments, asking them probing questions, getting them to expand upon their answers. The general consensus among the class is that both answers could be correct; however, Katie points out that the accepted answer is probably *better*. They spend at least fifteen minutes debating this question, not an uncommon occurrence according to Katie: "Sometimes the smarter the kid is the worse it is . . . I have to tell them, 'Look at the question. Do not read any more into the question.' . . . But some of them are the GT kids and they're good at questioning." (As the mother of two GT kids and a teacher of

many others over the past twenty-four years, I can readily attest to this.)

Oddly enough, Katie and Carla do their lesson plans together. How these plans play out in the classroom, however, could hardly be more different. Katie's desk, the windowsill behind it, the surrounding bookshelves - all are brimming with student "projects". Styrofoam cups, each with a student's name scrawled across it, contain spindly seedlings. Several two-liter bottle "ecosystems" (one per lab group) line one of the shelves. Brown objects that look somewhat like potatoes with grass growing out thickly at all angles ("chia pets" I'm told) stack side by side on the windowsill, waiting for students to take them home. Dissected seeds, peanuts under a microscope, the remains of a dissected flower - each add to the evidence of hands-on science all around me. These are not just demonstrations for the students to observe - they have been crafted by the students themselves. Although the students are reviewing for a test, primarily doing book work in this lesson, the atmosphere in this classroom feels completely different.

Today, Katie has brought a Venus flytrap to school. Evidently the students read about them in class last week and wanted to see one, curious about what they looked like in real life. As soon as she directs their attention to the plant, the students start hopping in their seats, chattering excitedly. She informs them that they can observe it more closely in a few minutes and asks them to get out their journals. However, as soon as she turns her back, several jump up and head for the flytrap. They can't wait. They grin sheepishly when she turns around and catches them in the act, but Katie just smiles indulgently and patiently admonishes them to return to their seats. She seems to

understand their fascination. "I want them to be interested, the 'Aha! I can do this! Look at this - I didn't know this!' There's so much they can see in the real world - like the flowers. They can go home and tell their parents, 'Hey look at this, look at this!' And they're learning it and they're having fun with it. It's not like, 'Mom, this is a NOUN!'"

In spite of her obvious interest in the subject and her ongoing attempts to instill that same interest in her students, science was not Katie's first love. In fact she's spent most of her career in insurance, coming to the teaching field just five years ago after her own children were grown.

> I never thought I could teach science . . . I didn't like science when I was in school because I didn't know anything about it . . . I went to school and got my degree back in 1978 - got my teaching certificate then - and science was not a big deal. In fact when I started teaching science [five years ago], my husband said, 'You don't teach science!' He was the science person. I didn't even take science in school unless I had to!

Curious, I ask her how her teaching style evolved. "The way I teach science - at first it was out of the book, because I was learning it as [the students] were. I didn't really know fifth grade science, so I've really learned a lot . . . I'd come in and say, 'Wow, I didn't know that. I guess I'd better learn it!' . . . I remember thinking [before I was a teacher], 'Well, who couldn't teach?' And then I found out!" she laughs. "It made me really glad I didn't say anything to the teachers when my kids went to school! I didn't think teachers did anything - I would think that when my kids would come home

with all of that homework, and I'd think, 'Gee, what do [the teachers] do?' And now I know!" We laugh together.

Katie doesn't credit the implementation of the science TAKS with her emphasis on hands-on activities in class. She credits the staff development and training she actively seeks out:

> I don't think the TAKS has changed the way I teach science. The way I teach science has changed because I've gone to workshops . . . I take classes during the summer to come up with ideas to teach [the students] during the year. They taught me a lot - more activities that you can do in the classroom to back up what you're teaching . . . This summer they let me go to one that was put on by the museum in Fort Worth and it was really good. It was a week-long course on inquiry-based teaching.

She tries to implement as many of these activities in her classes as possible. However, "teaching to the TAKS" takes precedence. "I've implemented some of them - manipulatives - because the kids love to mess with stuff . . . but I may have to wait until after TAKS in order to get into the inquiry-based instruction and do it justice."

Although Katie doesn't feel that the implementation of the science TAKS has affected her teaching methods, she does feel that it has influenced the emphasis on science and the amount of time spent on science instruction in the classroom. "When I first started teaching, science took a back seat. We were more concerned with math and threw in the science. [It was only thirty to forty-five minutes a day]. But since now they're testing it in fifth grade, it is important and we make sure we cover everything . . .

Now it's a full eighty minutes of science."

She also feels that the implementation of the TAKS, with its more intense pressure on students to pass reading and math, has influenced class size: "This year my largest class is twenty-nine. Last year my largest class was thirty-nine. I had that many students in one class. But that's the only way we could get it worked out so the math and language arts could get smaller classes . . . [the students] have to pass those to go on, so I had thirty-nine in science." She sees improvement in this area now, after Mr. Edwards, the district's superintendent, visited her classroom last year. After he questioned the principal, Ms. Kildare, about the situation, Katie experienced a twenty-five percent decrease in her class size this year. She doesn't blame the principal, however. Ms. Kildare, like other administrators and teachers alike, realizes that - when push comes to shove - reading and math have to take precedence. Consequently, she leaves much of the decisions about science to the teachers. "She wants the scores up, but she's not mandating a certain way to do it," Katie explains. "I guess [the administration] reviews our lesson plans, but they really don't say that much . . . They really leave me alone. I can do whatever I want to in the classroom. And I guess as long as my TAKS scores are okay, they'll keep letting me do that."

Katie feels that she works well in this environment, requiring little external motivation from the administration to attend further inservice training or to improve her teaching skills. Her newly acquired love of science (and teaching in general), as well as her genuine love and respect for her students, have lead Katie to develop a strong science program that appears to effectively mix hands-on activities with text-based

learning. When asked how much the students truly learn from these hands-on activities, given Carla's opinion of their drawbacks, Katie replies: "The kids learn so much. But it's important that you follow up [hands-on activities] and make sure that they're learning what they should be learning." When I ask how she accomplishes this, she emphasizes the importance of journaling. All of the students in her classes keep their own journal, writing in it every day. Although other teachers have mentioned this activity, Katie appears to be the most enthusiastic. She has attended several science workshops promoting their use, and sees journaling as the best way to tie up any activity in order to ensure that the students fully grasp the concepts they're studying. "Once you get through [with an activity], have them finish it up in the journal. Tell me what we did, tell me why we did it, tell me what you learned."

Katie's more involved, personalized approach with her students, as well as her dedicated efforts to improve science instruction in her classroom, particularly those of an "inquiry" nature, appear to create a classroom environment that is truly conducive to student learning. She sums it up: "The kids are interested in science . . . and they enjoy it!"

An Overview: Across the Spectrum

After observing and talking with the teachers at Harrison Middle School, I am convinced that each one desires success for their students, both in their science class and on the TAKS. However, the approaches to the achievement of this goal differ dramatically among these teachers.

Theresa's total focus on hands-on activities is required due to the nature of her

classes. However, among the science teachers in the regular classroom, Katie stands out as the one who most emphasizes hands-on experiences, mixing them effectively with text-based activities. Continuing down the teaching "spectrum", Josie emphasizes the paper/pencil text-based activities, but provides occasional hands-on experiences with frequent demonstrations for her students to observe (although the students are not always actively involved in their set-up). Finally, Carla lies at the other end of the spectrum, focusing primarily on paper/pencil tasks, with only sporadic demonstrations and occasional hands-on activities provided for her students.

Although each teacher agrees that the implementation of the science TAKS has increased the amount of time spent on science, their views of its impact on instruction are mixed. Most feel that the use of paper/pencil tasks, what Theresa refers to as "drill and kill" methods, have increased in the regular classroom at the expense of hands-on activities. Katie is the anomaly, insisting that the workshops she has attended have had more influence on her teaching methods, encouraging her to use more hands-on, inquiry methods of instruction. Since not all of the teachers have exhibited an interest in continuing their education in science teaching, the impact of such training on their teaching methods would therefore be minimal. Both Theresa and Katie extensively seek out opportunities for further growth in teaching science, particularly in the areas of hands-on teaching experiences and journaling. Their teaching styles appear to reflect their increasing knowledge of innovative science instructional methods. On the other hand, Josie and Carla rarely attend workshops in science. It appears that, without intervention from the administration, this situation will remain unchanged.

In addition to issues surrounding changes in instructional methods and time spent teaching science in the elementary classroom, other concerns related to the implementation of the science TAKS have surfaced throughout this study as well: those of leadership versus autonomy in the classroom, and accountability versus unintended consequences for the child. We now explore each of these issues from a "panoramic" perspective across grade levels and schools.

CHAPTER VII

A PANORAMIC VIEW

As I began this study, I debated several approaches to gathering and presenting the information I sought. Lightfoot (1986) claims that one of the dangers in educational research lies in focusing too heavily on the negative side - concentrating too much on what is wrong with the educational system, while giving little space to illuminate the positive as well. I could have actively sought out the "bad" teachers, the ones who have no clear purpose in teaching, who appear to have no real ethic of care for their students, who simply perform the motions of teaching and draw a paycheck. No matter what new program I studied, what policy I critiqued, I could have found myriad ways in which these teachers were failing our children - thus blaming the program or policy itself for the failure. I did not want to fall into that trap. I wanted the majority of the teachers I spoke with and observed to be the "good" ones - the ones who were "called" to teach (because I believe that the desire to teach is truly a calling). I wanted teachers who would try to make the best out of any situation, any program, any policy so that their students would derive the most benefit. I found those teachers at every grade level and in every school. Not that all of them fit the category. Not that any of them were perfect. But the great majority of these teachers were dedicated, concerned, loving teachers who truly cared about their students.

My purpose in this study originally focused on determining the ways in which "good" teachers were coping with the implementation of the science TAKS test - in changing the time they allotted to science, in changing their teaching methods, and in

interpreting mandates or directives from their superiors. From these teachers, I found some of my answers - and a great many more questions. I also found much that I did not originally seek - and these were perhaps the most interesting discoveries of all.

The Implementation of the Fifth Grade Science TAKS and Its Effects on the Amount of Time Allocated to Science Instruction: A Question of Priorities

The Lower Grade Levels

"Time" issues in first through fourth grades are not clear-cut. Ms. Taylor, the principal at Lone Pine, has not provided lab space for her teachers nor does she require specific amounts of time for science instruction. Perhaps it is not surprising, therefore, that Lone Pine teachers, for the most part, report no change in the amount of time spent on science. Moira, Cris, and Ricki all reported no change in their allotments for science. Only Sandy, the first-grade teacher, deviates from the norm - reporting that she currently spends more time on science than she has in the past. However, although her emphasis on science now appears more heavily grounded in the scientific method, her lesson plans still show (and she confirms) that she spends only an hour on hands-on science and an hour on book work each week for half of the six-weeks period. The other three weeks belong to social studies. She also admits that other teachers at her grade level spend even less. Both she and the remainder of the teachers that were interviewed at Lone Pine report the need to spend time on reading and math (and writing in the fourth grade) as a prohibiting factor for allowing additional time for science.

Most Clarksville Elementary teachers, on the other hand, report that the amount of time spent on science has increased as a result of the implementation of the science

TAKS. At first glance, Carrie, a first-grade teacher, and Chloe (from fourth grade) appear to break the norm in this school. Carrie doesn't feel that she spends any more time on science now than in the past; however, as a former kindergarten teacher, she has always allowed more time for science than most by integrating it with other subjects in her class (a very "kindergarten teacher thing to do", according to Carrie). Chloe, a former nurse, has also allowed for extra science time throughout her career - more from personal preference (a love for science) than from any external pressure. Yet even though her lesson plans indicate that she spends more time on science than any of the other teachers in the study, she reported spending less time than she would like, due to the pressure to teach the tested subjects of math and reading - and especially writing. The remainder of the teachers, however, credit the actual effects on time allotted to science in the classroom to their principal, Ms. Dean. The creation of the two lab rooms in their school and Ms. Dean's corresponding insistence on lab time at each grade level have both contributed to the increased allotment of "science time."

Although the implementation of the science TAKS may have instigated the efforts to increase time for science instruction in the lower grade levels (first through fourth), the deciding factor appears to be one of priorities, particularly if there is no strong administrative focus on science. Left to their own devices, many of the teachers at Lone Pine continue to neglect science in order to focus more on math, reading, and writing - the subjects tested at that level. On the other hand, although each teacher at Clarksville reports the temptation to focus more on these subjects, Ms. Dean's strong leadership style has provided an incentive to keep science "in the mix." Without her

leadership, it appears that science would have been relegated to the back burner by most teachers to make more room for the "tested" subjects as well.

The Fifth Grade

The implementation of the science TAKS test at the fifth grade level may not have started lab science instruction at Harrison, but it has definitely influenced the recent emphasis on science as well as the amount of time spent on that subject in the regular classroom. No one would question that the amount of time spent on teaching science in the fifth grade has increased at Harrison Middle School. Every teacher at this school, as well as their principal, agree that the time allotment for science has grown dramatically since the implementation of the science TAKS. When asked whether the TAKS had influenced the amount of time spent on science, Ms. Kildare confirms this:

> Yes it has, especially in the fifth grade. Last year we had the science teachers teaching science and social studies, but we've pulled [the science] out by itself. They are incorporating the language arts and social studies, which is very easy to do. You can teach your reading through social studies, but science stands alone. Now if they start giving the social studies test, I don't know what we're going to do [she laughs].

As shown in Chapter VI, every teacher at this grade level gives the implementation of the science TAKS as the driving force for the change in time allotment for the fifth grade. With science as a TAKS-tested subject at this grade level, the rationale for this change seems evident. Science is a priority. With most of these teachers teaching only science, there is no interference from other tested subjects.

However, Josie (who teaches both science and math at Harrison) readily admits that when push comes to shove, math still gets the upper hand. Since students must pass the math test to move on to sixth grade, teaching science once again becomes a question of priorities when the gate-way subjects of math and reading are involved.

The Implementation of the Fifth Grade Science TAKS and Its Effects on Science Instructional Strategies: The Tension Between "Best Practice" vs. Success on the TAKS

The Lower Grade Levels

Although Lone Pine teachers feel that the implementation of the science TAKS has encouraged a greater emphasis on the TEKS, they report that there has been little change in *how* they teach science. Sandy reports focusing her lab activities more towards the scientific method, but neither she nor the other teachers feel that their style of teaching has changed. Most were "hands-on" teachers before, and remain so now. Unfortunately, they report that other teachers at their grade levels, those that were more paper / pencil-oriented in the past, have retained their teaching styles as well. Teacher preference remains the deciding factor in their choice of teaching methods. Some of those interviewed cite the lack of emphasis on continued training in science as a possible factor for these teachers' continued dependence on "textbook science". And while Sandy has influenced some of the other first-grade teachers to add more hands-on, inquiry experiences into the science lessons, the lack of horizontal teaming, with teachers working together to develop lessons, results in little incentive for the remaining first-grade teacher (or the rest of the teachers, in general, according to Moira) to increase hands-on experiences in their classrooms. Since both inservice training and horizontal

teaming appear to contribute to the choice of instructional strategies, leadership style becomes a determining factor once again.

This leadership factor is made even more evident at Clarksville, as teachers, unlike those at Lone Pine, report a variety of changes in instructional strategies since the implementation of the science TAKS, both for themselves and for other teachers throughout their grade levels. Some appear positive - more focus on the TEKS, more hands-on experiences, a greater tendency to look at science concepts and analyze how they're being taught. However, others may not be quite so positive: more "drill and kill" paper work reported by some teachers, a greater focus on multiple choice types of questions rather than open-ended, higher-order questions. Nevertheless, based on the teachers' comments when interviewed, Ms. Dean's leadership style decidedly influences these strategies.

The most often-cited change in science instructional strategies at Clarksville has been the increased participation in hands-on activities among those teachers who formerly emphasized more paper-pencil tasks. Horizontal teaming with other grade-level teachers provides a strong incentive for these teachers to include hands-on science activities for their students, as does Ms. Dean's insistence on lab time for the students each week. In addition, according to Clarksville teachers, attendance at the science staff development opportunities required by Ms. Dean results in increased content knowledge as well as a greater repertoire of hands-on activities, raising the comfort level of those teachers who may have had little science training in the past.

The TEKS covered on the science TAKS, as well as the types of questions asked

on that test may have illuminated the necessary changes in strategies needed at the elementary level. However, the administrative leadership styles adopted by Ms. Taylor and Ms. Dean at their respective schools, as well as individual teacher preferences, appear to be major determining factors in the actual implementation of these strategies in the classroom.

The Fifth Grade

Chloe sums up the feelings of many of her fellow teachers in the lower grades levels: "I think the further away you get from the fifth grade the less effect the [science] TAKS has." Whereas the implementation of the science TAKS has influenced science teaching in these lower grades levels to a certain extent, by far the greatest effects have been in the fifth grade. Teachers at that grade level all express the belief that in-depth coverage of science topics as well as frequent hands-on experiences exemplify the "best practice" methods for science instruction. However, of the regular classroom teachers, only Katie seems to adhere to these methods, incorporating a variety of hands-on, inquiry-based experiences for her students. Although Josie and Carla both concur that these are the best practices, their desire to have their students score well on the TAKS, the push they feel to cover all of the material, and the practical issues of student behavior during hands-on experiences all convince them that they must reduce the hands-on activities, assign more paper / pencil tasks, and teach from the "less is more" philosophy (cover more topics less thoroughly). Yet this conviction seems unfounded when their students' average science TAKS scores are compared to the scores of Katie's students. According to Theresa (who is also the math / science instructional specialist for the

middle schools in the district), Katie's students scored almost twenty-five percentage points higher than those of the other two. The level of enjoyment and interest in science also appears higher for the students in her class, based my observation of their participation in the activities and their responses in class. All three teachers experience similar conditions and logistical constraints in their classrooms, but Josie and Carla choose to respond differently despite the indications that students do better on the science TAKS when exposed to more hands-on, inquiry experiences. It appears that individual teachers, rather than an entire school district, are making the choice between a "ratings-based response", which seeks to prepare students for the state tests in order to achieve higher scores and ratings, and a "reform-based response", which emphasizes professional development for teachers and activity-based learning for students (Sloan, 2005). Josie and Carla truly feel that their "ratings-based response" is necessary in order for the students to improve their performance on the TAKS.

As with the lower elementary grades, leadership issues crop up once again. The principal, Ms. Kildare, encourages hands-on activities; however, there is no real accountability. As far as the teachers know, their lesson plans are never checked for science activities. "I guess they don't care as long as our scores stay up," Katie comments. Her simple statement, "I can do whatever I want to in the classroom," speaks volumes. While this might work well for Katie, who actively seeks out new instructional strategies in science by frequently attending workshops, Josie and Carla need greater incentive to place more emphasis on hands-on activities and less on the paper / pencil, TAKS-formatted materials. They also need more encouragement to

attend further teacher training. Although each admits to the need for more staff development, neither expressed a desire to actively search out those opportunities. Without strong administrative leadership, there seems little likelihood that the situation will change. The implementation of the science TAKS provides the pressure to teach science at this grade level - to increase the amount of time spent on science and to ensure coverage of the TEKS - but the pathways chosen by the teachers vary greatly. In the absence of strong administrative encouragement otherwise, personal preferences in teaching methods appear to have the greatest impact on the way science instruction actually plays out in the classroom.

State and Local Mandates Concerning Science Instruction and Preparation: Teacher and Administrator Perceptions

Dr. Ben Edwards, the superintendent of Atkins ISD, is a friendly, talkative individual with a ready smile. Tall and slender, with graying hair and glasses, he makes a determined effort, when conversing with others, to put them at ease. As the superintendent, he understands the importance of the state's TAKS system. He comprehends the implications if the school district does poorly on the assessment system - both from an academic standpoint and an economic one as well. In fact he gives these state mandates and requirements more credence than those at the national level:

> Quite frankly, we haven't given [NCLB] the emphasis that we have TAKS because it's probably going to go away as soon as we lose a Republican president anyway, hopefully. We try to make sure we fulfill all of the requirements of NCLB, but it's secondary behind TAKS and behind educating the child.

Despite the pressure placed on school districts to improve TAKS scores, and the mandates placed on him at the state and national level, he does not hand down strict mandates and directives for science himself, other than those pertaining to the development of scope and sequence documents and TAKS-formatted six-weeks assessments at tested grade levels. "There are really no [other] mandates from here . . . I think our staff puts too much pressure on themselves. So, any more from us would be suicidal." Not that he feels no push from his superiors at the local level: "We want to make 'Recognized' and make everybody happy. And it's difficult to get there. But when I look at this [school] board and the goals they have for me, 'Recognized' and 'Exemplary' are there."

In the light of these goals, and after several parent and student complaints, the board provided money three years ago for the creation of a science lab at Harrison's sister middle school in the district, according to Dr. Edwards. The rationale for the money spent: the implementation of the science TAKS at the fifth grade level. In addition, the school district created new positions at the administrative level - two curriculum coordinators, one for the elementary and one for the high school level. Recently, the district also provided stipends for thirteen classroom teachers to act as "instructional specialists" - one from every grade level, kindergarten through eighth, and one from each of the four TAKS-tested subject areas (language arts, social studies, math, and science) at the high school. Currently, their sole purpose lies in creating TAKS-formatted six-weeks assessments which are aligned with the district's new scope and sequence. At the elementary level, these assessments are given only to those

students who are being tested in that subject at that grade level. Basically, that means there are no science assessments until the fifth grade - the first grade at which science is tested - and therefore no accountability for science prior to that grade level.

There are no requirements from the central administration as far as time requirements for science instruction are concerned. Oddly enough, every teacher in the first through fourth grade that I interviewed believes that the district requires them to teach three weeks of science and three weeks of social studies each six weeks. However, Lone Pine principal, Ms. Taylor, informed me that it was more or less the school district's version of an "urban legend". "The teachers just started doing it that way several years ago in order to get everything in," she commented, "and we just kept doing it that way. All of the teachers now think that's what the district mandated, but there was never any such requirement."

There are also no requirements for science staff development handed down from the central administration. Heated discussions spring up among teachers when staff development issues arise - all of the teachers who were interviewed express discontent with the professional development opportunities provided by the district. At the district's K-4 science workshops at the beginning of the school year, few classroom teachers were represented. The teachers from Lone Pine who attended one of the workshops were the physical education teacher, the music teacher, and two special education aides. These four were the only teachers in the workshop. Another science workshop given for the K-4 teachers had only four teachers in attendance as well. Helen comments, "It's embarrassing. Our district paid all of this money and no one showed

up . . . They were all in math and reading. It just seemed so disorganized." Two other elementary science workshops fared no better. One of these workshops had six in attendance while the participants at the other workshop were all from a single school in the district. The teachers, lacking specific requirements for training in science, chose (or were asked) to attend those workshops which covered "TAKS-prioritized" subject matter at their grade level.

Clarksville teachers did not attend these workshops in high numbers, either; however, Ms. Dean provided science inservice training for them the week before, which they were required to attend, and she spent seventy-five dollars per teacher for the day's activities and the materials they took back to their classrooms. For the district's staff development, on the other hand, teachers from Clarksville (as per the district's requirement) primarily attended workshops dealing with information technology or with issues surrounding economically disadvantaged students. There were no such requirements for science. The district's lack of interest in emphasizing training in science content as well as in hands-on instructional methods eventually trickles down to the teachers (and administrators), apparently with one message: science is not a priority at the elementary level.

For the principals at the elementary schools, therefore, the external pressure from the central administration to encourage science in their schools seems virtually non-existent, other than the scope and sequence documents and the students' six weeks assessments at each tested grade level. The principals at each of the three schools respond differently to this type of leadership. Ms. Taylor, Lone Pine's principal,

confesses that she has never actually seen a fifth grade science TAKS. In the absence of directives from the local administration, she puts her entire focus for science on the teaching of the state-generated TEKS. "The TEKS are the state mandated curriculum and we have to do them." She, in turn, does not hand down mandates to her teachers, trusting them to teach those TEKS. "We were informed that most of the material [on the test] is pretty much covered in the second and third grade TEKS, so we need to make sure that we're hitting those areas and also reinforce them in fourth grade." However, as has been shown previously, teachers in the classroom - in the absence of clear directives - often base their teaching methods on personal preference, or they prioritize subjects, giving more time to those tested at their grade level. At Lone Pine, it appears that few, if any, mandates concerning science education trickle down to the actual teachers in the classroom - other than vague directives to "teach smarter" by integrating science with other subjects, or non-specific requests to "please help out the fifth grade teachers" by teaching more science. According to the teachers in this school, virtually all mandates they receive deal with reading, math, or writing.

On the other hand, at Clarksville, in the absence of mandates from the central administration, Ms. Dean draws on her own leadership abilities to ensure that teachers include frequent hands-on science instruction in their classroom. Although she doesn't feel that she issues mandates and directives, her teachers know what she expects. These "indirect mandates" manifest themselves in the weekly lab time that teachers schedule into their lesson plans and the workshops they attend on a regular basis. In a nutshell, the state mandates and suggestions appear to bypass the central administration, filtering

through Ms. Dean to her teachers. They view her "suggestions" as mandates and respond accordingly.

The response of teachers at Harrison appears more ambiguous. Other than those concerning logistical issues, (such as class size, time frames, etc.), Ms. Kildare feels that she gives few, if any, real mandates or directives concerning science to her teachers. Consequently, faced with the pressure of the science TAKS at that level, teachers seem to focus on their TAKS scores as the "prime directive". The teachers feel that as long their scores "stay up" (hopefully high enough to attain "recognized" status from the state), they have control of their own classrooms, and can teach according to their own personal preference. Ms. Kildare strongly believes in the importance of hands-on experiences and makes that fact known to her teachers; however, she does not go over lesson plans with her teachers, and this practice results in an even greater sense of autonomy among the teachers. On the other hand, even lesson plans would not tell the complete story. Katie's and Carla's lesson plans are identical, even though they teach primarily from opposite ends of the hands-on / paper-pencil spectrum. It appears as if the teachers' beliefs about how students must be taught in order to do well on the TAKS act as an umbrella, effectively shielding the teachers from any directives or "suggestions" that might try to trickle down from the campus administration.

Basically, at each grade level, the teachers appear to perceive the mandates from the state in two ways: teach what is tested at their grade level and increase student scores. The actual accomplishment of these goals, however, seems to depend upon teacher preferences as far as methodologies are concerned, as well as the guidance they receive

at the local administrative level.

CHAPTER VIII

OTHER VISTAS

I found much throughout my study that I did not originally seek. Issues surrounding leadership, accountability, and the side effects of the high-stakes testing system did not arise in my original research questions. However, in the process of discovery - so inherent in a qualitative, interpretivistic study - these issues came to light. I find them worthy of discussion here.

Leadership: A Determining Factor in the TAKS Environment

One of the most glaring differences between the campuses became evident fairly quickly in the interview process - that of leadership. Leadership styles vary markedly among the three principals; however, it is most dramatic between the two principals at the elementary school level. Both their interviews as well as the descriptions of their teachers portray these women as lying at apparently opposite ends of the leadership continuum, at least as far as science instruction is concerned. Ms. Taylor's more "hands-off" approach towards science instruction at Lone Pine contrasts with Ms. Dean's more structured and authoritative approach at Clarksville. Both principals have a clear vision of what they want for their schools, for their teachers, for their students - and they both express strong opinions of how they want to achieve those goals. However, the vision for science education, which Ms. Dean's teachers readily articulate, appears somewhat murky and ambiguous among Ms. Taylor's teachers.

"Do what you need to do - you know what you're supposed to do - I'm trusting you to get it done. You know what the objective is - just do it," Ms. Taylor tells her

teachers. "Teach the TEKS!." Though she expresses these goals for her teachers, she does not appear to provide much in the way of tools to achieve them. As she commented earlier, Ms. Taylor admits that she has never looked at a science TAKS, and has not required her teachers to do so, either. "Ms. Taylor has not pulled us together as a group where we all sit together and talk about this objective or that objective," third grade teacher, Cris, comments "I think that she expects us as a grade level to kind of look over what we need to work on." However, with little horizontal alignment or teaming (recall Moira's statement: "We don't keep up too much with who's doing what") and no evident vertical curriculum alignment, teachers simply don't take the time to do this themselves.

As far as facilities for teaching science are concerned, her teachers are frustrated. Mandy, another fourth grade teacher at the school, expresses this frustration: "We have an empty room over here and we'd love to use it - if we just had some tables in there it would be a great lab . . . Here it is at the end of the first six weeks and all we need are some tables . . . It's just a matter of someone taking the time." In addition to lab space, materials to teach science also concern the teachers. "We bought up a bunch of science supplies," a Moira, the second grade teacher complains, "but me and two others were the only ones that ever got into that closet. And everyone else was like, 'Oh, we have that?' It was like it was some big mystery and we were keeping it a secret."

Nor does Ms. Taylor place science staff development as a priority on her campus. When asked about science inservice opportunities provided for her teachers, she replies, "I can't recall what we've done for science. I can't off of the top of my head recall what

we've done specifically this year for science." As mentioned previously, when asked if she requires attendance at any science workshops, Ms. Taylor admits, "Not yet. I haven't yet. Not on this campus." Ms. Taylor's teachers all agree that the workshops she provides, or requires them to attend at other locations, clearly emphasize math, reading, and writing.

Ms. Taylor strongly believes in hands-on instruction in the classroom. "Science needs to be hands-on," she claims. "Constant reinforcement of the scientific process and that type of thinking." However, little accountability exists for teaching science - hands-on or otherwise - in the classroom. No six-weeks assessments exist for science at this level, and Ms. Taylor has not, up to this point, gone over lesson plans with her teachers to encourage them to include hands-on experiences for their students. Mandy expresses her uncertainty: "I think our principal is aware of what's going on, at least somewhat." Not one teacher spoke of leadership in general, or their principal specifically, as a factor in their commitment to teach science on a regular basis. (And as a result, some teachers *don't* teach science on a regular basis.) Contrast this environment with that established by Ms. Dean.

"Ms. Dean is all into inservices," Chloe states.

"It just helps when the principal is right behind us getting us the materials we need," Helen claims.

"It all depends on the principal and how they do things. That does seem to be a determining factor," Becky affirms.

"We are vertically and horizontally aligned at this campus. That is a direct result

of TAKS and our administrator, Ms. Dean. She has made a point to get vertical and horizontal alignment. Administrators make a difference," says Lori, a second grade teacher.

These comments by Ms. Dean's teachers demonstrate the importance they place on the support and encouragement of their principal, particularly when it comes to science education. Each teacher knows what she expects in terms of attendance at science staff development opportunities, teaching the TEKS, and teaching hands-on activities in their classroom. However, these are no vague missives trickling down through the ranks. Ms. Dean checks lesson plans, sets up science workshops, and provides lab rooms and materials for her teachers. She explains:

> I always felt that if you had good staff development and provided things so that teachers wouldn't have to run around all over town getting stuff . . . I mean, you can order kits and it's more expensive. But the thing is, you've got everything right there and all you have to do is replenish it . . . I bought these kits . . . and there's like twenty experiments already in a box. And we have a check list . . . [The teachers] just check it and I'll go to Wal-Mart - I can get almost everything we need at Wal-Mart in one afternoon. This year I went over there and got batteries and baking soda and beans, you know rubber bands and golf balls. I mean it was EASY. I got everything for like forty dollars. And I came back and it was very simple - I knew where everything went because there was the check list on the box. I just opened it up and dumped it in there. And that's it.

Ms. Dean doesn't wait for someone else to take the time. She does it herself.

Furthermore, as mentioned earlier, she not only works with her teachers to analyze former science TAKS tests, but also digs to find out how students from her school perform on the test when they get to the fifth grade - what they're missing, where their weaknesses lie. By sharing this information with her teachers, she creates a somewhat competitive environment - one that appears to foster teamwork. Setting up strong horizontal and vertical curriculum alignment in and among the grade levels also results in an increased sense of teamwork. Horizontal teaming (and, to a certain degree, instructional alignment) also plays a part: "We share our lesson plans," Lori comments. "We all have it in the computer and everyone is doing everything straight across the board. There is horizontal alignment - a teamwork situation."

In the current TAKS environment, test scores often determine the public view of a school's success. Although both Lone Pine and Clarksville have received "Recognized" status for the past several years (Clarksville reached "Exemplary" at one point), Clarksville's TAKS scores average higher than those of Lone Pine, as shown in Table 7.

TABLE 7
2005 TAKS Scores for Lone Pine and Clarksville

School	Reading (3rd Grade)	Math (3rd Grade)	Writing (4th Grade)
Lone Pine	91	85	86
Clarksville	96	88	98

SOURCE: Texas Education Agency (2005)

With similar demographic profiles in both schools, it could be conjectured that differences in leadership styles and school structure might be partly responsible for these results. It must be remembered, however, that these scores were obtained during the first year of Ms.Taylor's principalship. Passing rates did increase at her school from the year before, although they were still below other campuses in the state with similar characteristics. Since many of the policies concerning instruction were in place before Ms. Taylor's tenure, the leadership style of the former principal (who was reportedly more "distanced" from her teachers and less structured than Ms. Taylor's in science as well as math, reading, and writing) is definitely an issue. Consequently, leadership once again appears to be a determining factor for success in a TAKS world.

As a strong leader herself, Ms. Dean sometimes feels frustrated with the less authoritative central administration in the district. "Sometimes I get really disgusted because I think we don't have any leadership in the curriculum . . . They wait until we're in a crunch before they do anything and the they quickly put a band-aid on it and try to fix it. It just aggravates me . . . It's like there's no direction - there's no leadership. They get tunnel vision sometimes." As an outspoken individual who is known throughout the district as one who does not hesitate to express her opinion, Ms. Dean sometimes steps on toes. Not all teachers work well under her domain. Some have transferred to other campuses or to other districts altogether. Those that have remained, however, clearly feel that Ms. Dean is the driving force behind much of their commitment to science education in their classrooms.

Many teachers feel comfortable with the environment established by Ms. Taylor

as well, particularly the "mavericks" who tend to branch out and try new things on their own. The greater autonomy of that environment appeals to them - they feel more latitude to experiment with new techniques and methods. They thrive in this type of situation, and would perhaps feel stifled in a more structured system. After all, a fourth-grade teacher from Lone Pine, who attends workshops and finds and develops science activities on her own, draws the most praise from the fifth grade teachers at Harrison for preparing her students in science - although they feel that Clarksville students perform better in general. This raises several questions: Do certain types of teachers achieve greater success under different leadership styles? Does one leadership style result in clearly stronger academic programs? Does a less regimented leadership style foster more imaginative and creative thinking as teachers develop science activities, while another leads to more standardized teaching?

Regardless, the bottom line appears to be that structured leadership styles embraced by leaders who provide materials and facilities which promote hands-on, inquiry based instruction in science; encourage professional development in science as an integral requirement for school improvement; and help to develop a horizontal and vertical curriculum alignment system that fosters an atmosphere of teamwork achieve a greater level of success in the current TAKS environment.

Accountability and Children: What Goal Is of Most Worth

When I began this study, I had many preconceptions about elementary teachers, about high-stakes testing and children, about the side effects of testing science at the elementary level. Some of these preconceptions remained intact by the study's end.

Others turned one hundred and eighty degrees in the opposite direction, only to shift back and rest at some odd angle in between.

I expected to find teachers who were frustrated with accountability in general, raging against a system that used single multiple-choice test scores to judge their efficacy in the classroom. After all, the media seemed to view teachers in that light, with state legislators referring to "whiny-assed school people" (McKenzie, 2005) and their constant complaints about problems in the educational system. However, with virtually no exceptions, I found teachers who embraced accountability for themselves. "We have no problem being held accountable," says Lone Pine teacher, Cris. "That keeps you going down the path that you have to do." From Becky, at Clarksville: "I understand the accountability part and I don't have a problem teaching the skills or the TEKS or anything at all like that." Kate, from Harrison, agrees: "There has to be some way to make sure the teachers are teaching . . . There are teachers out there that aren't in it for the right reason. The teachers have to be held accountable."

These teachers are quick to point out positive aspects about the system. Fourth grade teacher, Ricki, from Lone Pine, explains: "I can see some good things [about the TAKS]. You can't wait. I mean, we have some kids that are new to our school. And within the first two weeks, we're already asking how we're going to help these kids. You can't just say 'they'll get it later' or 'no, they're just not going to get it.' You just can't - you've got to find some way." Ms. Taylor, the principal from Lone Pine, continues: "That's the one thing about accountability: like it or hate it, it does make people more aware and try new things to help the scores."

However, these same teachers and administrators - who unanimously affirm the necessity of accountability in our educational system - vehemently oppose the high-stakes testing of children at the elementary level, preferring a strong commitment to early intervention within a system that uses multiple criteria to gauge a child's academic success. Carrie, the first grade teacher from Clarksville, explains:

> It's just like when you get sick. Do you go to the doctor when you get sick, or do you wait until three years later until you're almost dead before you go to the doctor, before you get medication for it? If you can't hear [in kindergarten], do you wait until third grade before you get some device to help you hear? No, you don't waste kindergarten, first, and second grades before you do something. And if you know there's a problem [in school], you intervene, you correct that at the earliest stage so that learning can continue.

"Early intervention," Cris claims, "that's the only thing that's going to make a difference."

These teachers are no less confident that a multiple criteria system would be more beneficial in determining which children need early intervention than the current "one-shot", multiple-choice testing system. "I have always believed that the more information you have, the better able you are to make a decision," Carrie comments. "I don't think that one particular [test] can tell whether a child knows the information or not. There are too many variables. What's going on at home? Did they get any sleep? Are they sick? Are Mom and Dad punching each other? There's just too many variables." Josie, a fifth-grade science teacher continues:

> I think [a multiple-criteria system] would be a much better accountability for the child and for the teacher to have - because then it's not just one picture of one day of the entire school year to look at everything they've done . . . A one-shot test. I have one kid that took every benchmark - 90% on it - and her dog died the morning of [the TAKS] and she failed it. And then she spent six weeks of class in a title reading class and didn't need to be there. Because her dog died the morning of the test and it automatically made her have to take the title reading class. You know, there are things that are causes that are never taken into account. And that's not what the state sees. And they don't get that side of the story.

Virtually every teacher interviewed mentions the benefits of a multiple criteria system to gain the most accurate picture of a child's academic success.

However, as far as the current testing system is concerned, these teachers are adamant. "I think it's too hard for them," Mandy, a fourth grade teacher at Lone Pine, says firmly. "I think that we're pushing them too hard. I think it's too much for this age." Carrie agrees: "They have increased the demands on children so much that it has become very stressful to children. And we're requiring more and more and more of these children at an earlier, earlier, earlier age and at some point there has to come a point when you say, 'Wait a minute, WHY are we doing this?'"

In the spring of 2005, before my study officially began, word about the topic of this study was already out at Lone Pine. One afternoon I visited the school, and as I walked down the hall, a teacher stopped me. In her arms she carried a young boy who

was sobbing - his head on her shoulder. She introduced herself to me and asked that I please interview her when I began the study. She pointed at the child she was carrying: "This is Brian. He's been working on his reading TAKS all day long [a total of six hours by that time]. I'm taking him to the nurse right now because he's bitten his fingernails so much today that all of his fingers are bleeding. He's eight years old. I can sure give you some information about how all of these tests are affecting our children." Unfortunately, when I tried to find this teacher the following year, she was no longer teaching at Lone Pine. According to the principal, she had retired.

Fifth grade science teacher, Carla, expresses her opinion: "I don't like [high stakes testing], because some students can't take tests well. They're just not test takers. Some of them just get too stressed out. They get way stressed out over a test - it's ridiculous how much they get stressed out over it." Josie, another fifth grade science teacher, begins to cry as she describes the beginning of her science class this year:

> Even in August, before the fifth grade had really started, the first quiz I gave, I literally had kids that were sick to their stomach. They are ten years old and they are going home sick to their stomach over a quiz - not even the word test. I never mentioned the word quiz or test again in my classroom the rest of the year. I could not say those words, because literally those kids were getting sick - the kid that would sit over there and shake and the kids that would just sit and wipe their sweaty hands and they would wipe them on their pants and they would cry. They should be running around playing with their friends. But they're sick, they're sick to their stomach. They're buckling under the pressure and they're ten years

old.

The administrators agree. "I just hate it," says Harrison's principal, Ms. Kildare. "They just don't realize what amount of testing time is given to our students. We test them to *death*." Dr. Edwards, the superintendent, admits coming to this school district because the TAKS system was not "beaten to death". His view of the testing system perhaps explains why he does not hand down strict mandates or constantly pressure his administrators and teachers to achieve higher scores:

> Kids aren't kids any more. I mean, if we have fifth graders throwing up before it's time to take a test, there's something wrong with the system . . . And I'll use my Jurassic Park example: Just because we *can* do something, *should* we? Those people figured out they shouldn't have cloned the dinosaurs, but they could, so they did. And we can force these kids to reach these different levels and do well on the test, but should we? I think that we've taken the play out of school, we've taken out the social pieces that are going to impact us long-range . . . And I'm quoting Tootie Byrd [a retired counselor and humorist from Austin, Texas] when I say that if we educate their heads and not their hearts, then we turn out intellectual barbarians. And I'm afraid that's where we're headed.

As these educators question the system, it appears - over and over - to come down to one over-arching theme: What are our goals in education? What is our main purpose in educating children? What goal is of most worth? For most of these teachers, their educational focus has nothing to do with facts or figures, programs or policies, mandates or methodologies. Their philosophy lies in leaving children with one very

important tool: the love of learning. Over and over, these teachers spoke of their fears that the TAKS testing system, in general, and the implementation of the science TAKS, specifically, would erode that love. Carrie spoke most eloquently:

> I think it is detrimental to our children. I think it is detrimental to our profession. I think it sends the wrong message about learning - that it's about facts. Do I happen to know that fact on that day? I think it takes the emphasis away from learning just for the knowledge and that learning is a life-long goal - you never stop learning. But I think that we test, test, test, test, test and we make children hate things. And I think that's what we're doing to our children when we test them and put such an emphasis on the test and passing a test - that the test is more important than the pure joy of learning for just fun, for just enjoyment, for just the knowledge that we can get . . . Learning shouldn't be fearful - that's not what learning should be about.

Many teachers, feel that the implementation of the elementary science TAKS has resulted in an increase in the emphasis placed on science in the elementary classroom - particularly as they approach the fifth grade. Some feel that science is often taught "better" now, with more time spent on science and more hands-on activities in some classes. However, at what cost? "I just don't want it to take the joy out of learning," Becky laments about high-stakes testing in general. "And I'm afraid that for many children it's done that with the stomach aches and the headaches. And that just kind of makes me sad. That's my honest opinion."

Some feel that science has become "just another tested subject", as Ricki, a

fourth grade teacher from Lone Pine, claims.

> I don't know if they just didn't think it through or just were in such a hurry that they had to get something in place or if it was a political platform. I'm not sure where it came from but I just don't think it's the most effective way to do things. I don't think that kids glean an appreciation for science that way - or any other subject. They just think, 'Oh, no, it doesn't matter what I do all year long - I just better pass the test.' So I think that it's just kind of unproductive.

The superintendent, Mr. Edwards, agrees:

> Kids grow up with science, playing with bugs, measuring things - they grow up with that. So it is natural to enjoy it. But I'm telling you, any time you get beat up with something - when it becomes punitive, then we all tend to buck it whether we're kids or adults. Just like if we assign too much reading, then that kid loses that love of reading. It's the same process - you've got to be very careful about that, and I'm afraid we're pushing them away from it.

One important goal might be to ask ourselves what *kind* of science we want our children to learn. As I listen to my own third grade daughter as she attempts to memorize the meanings of her science vocabulary terms (which also serve as her spelling words), I wonder what she is learning about "mutualism", "commensalism", "food pyramids", "ecology", and "endangered species", other than rote definitions. She claims that they have done no activities other than worksheets with these terms. I contrast this with the science I had as a child. Although not sophisticated, perhaps, by today's standards, I remember all of us bringing rock collections and bug collections for

show-and-tell, searching for leaves outside, looking at a snake my teacher brought to school, peering at all manner of things under a magnifying glass. I don't remember memorizing any of these definitions - and I certainly didn't have "commensalism" on my spelling list in third grade, but I do remember my excitement in discovering the world around me - an excitement that remains with me still today.

When teachers speak of units or activities that they love, but are unable to teach because they do not fit in any of the TEKS categories for their grade level, it saddens me. Theresa spoke of ecosystems that her students could no longer make and spend time studying. Chloe spoke of a teacher who built "space labs" which provided her students with related science activities that they found interesting and exciting - yet that teacher dropped those activities (which were not part of the TEKS for that grade level) due to time constraints. At one of the district inservices that I attended, the workshop leader stated over and over, "If it's not in the TEKS, you just can't teach it. Forget those 'love' units and stick to the TEKS!" She herself spoke of her love for aviation and aeronautics, having spent two summers at an institute in Colorado developing activities for those topics that could be used in her middle school classes. "But when we started the science TAKS, "she said, "I knew that I had to give up those activities. They just weren't on the TEKS." I just cannot keep from wondering how much more her students would have gleaned from her science classes had she left these topics, which she was clearly interested and excited about, in the curriculum. I simply do not believe that memorized facts and disconnected snippets of knowledge about a wide range of topics could ever replace the enthusiasm that results when students see the excitement and enthusiasm of

their teacher - regardless of the science topic.

So the question remains: What goal is of most worth for children of this age? Memorized vocabulary, facts, and formulas - or a true fascination with the world around us? I know what I would choose - after all, it was that fascination that drew me to my career as a science teacher.

Relationships: Commitment to Children in a TAKS World

Beyond the effects on science, beyond accountability and goals, one of the discoveries that most impacted me personally dealt with the relationships between teachers and their students. As I pointed out in the beginning, I am a passionate teacher. Therein lies my subjectivity. When I speak of student-teacher relationships, I cannot remove myself from my subjectivity - it is too deeply ingrained. It is why I am still teaching after twenty-four years, as enthusiastic as the day I began. I love my students. I care about their lives, their backgrounds, their families. I feel their sorrows and their joys. I rejoice in their success and spend sleepless nights when they fail. My relationships with my students have brought me some of the most rewarding moments of my life. I truly believe that a caring relationship must be formed with students before effective teaching can occur. Most of the teachers that I have encountered throughout my career seemed to have had that kind of commitment to their students - to *all* of their students.

However, as I talked with the educators throughout my research study, time after time they made references to “ELL” students (English language learners), “bilingual” students, “special ed” students, “economically disadvantaged” students. And the vast

majority of the time, these references dealt with the problems these groups of students presented in terms of scores and ratings. These students seem to have become a label - an impediment - rather than simply individuals who need special attention and a deeper commitment. Chloe, from Clarksville, complained;

> I don't think the rating system is fair - because the one school that was 'Exemplary' this year - they don't have enough economically disadvantaged this year to count. If we counted just the categories that they counted, well we're not 'Exemplary' because we have enough economically disadvantaged kids and those groups don't have a good percentage so you don't get a good rating.

Carla expresses her opinion: "I have a lot of special ed kids in my class this year. And that's not fair with some of the others that don't have near as many. And I don't have a lot of parent support either. The kids go home - who knows what they go home to. Their parents probably aren't even married - they're out working or they're gone." Ms. Dean, the principal at Clarksville, sees the results of this type of attitude from an administrative standpoint:

> I actually know of principals who have told kids to transfer to another campus in our district because they thought they were going to affect the scores in their campus. And they've transferred in here, and parents have told me that they have transferred because of that. And I said, "That's fine. We'll take them" . . . And one campus will have to have bilingual kiddos so I volunteered Clarksville. And someone said, "Oh, you're shooting yourself in the foot," because the Hispanic students are the ones that will pull the TAKS scores down. But I don't

> worry about it. I don't worry about the TEA rating for the campus. I never have . . . I just teach kids.

A principal from another elementary school outside this district had more to say:

> I've actually known principals who wouldn't hire someone as a teacher if they found out that they had a "special needs" child and were bringing them with them to the school. It's horrible, but some administrators don't want students to come into their school that have to take the tests and might bring down their scores. I wish it didn't happen – *I've* never done it – but I know that it does happen sometimes.

When students are looked upon as faceless groups, seemingly important only for their effects on TAKS scores, I have major concerns. I am very much afraid, from what I have seen and heard throughout this study *from the "good" teachers*, that I have reason to be concerned. If a side-effect of the current high-stakes testing environment becomes the erosion of teacher-student relationships, then my earlier question remains: What goal is of most worth? Increasing the time allotted for science, providing more hands-on experiences for students, encouraging continued training for teachers in science, promoting horizontal and vertical alignment in and among grade levels, fostering teamwork, establishing strong leaders in administrative positions - none of these, in my opinion, will mean anything - none will accomplish anything of real importance - if those caring relationships between teachers and students fall by the wayside.

CHAPTER IX

SUMMARY AND CONCLUSIONS

The Current State of Science Education

The conclusions of this study are the result of my analysis of the current state of science education at the participant schools in light of the implementation of the fifth grade science TAKS. Four findings are of significance: what is tested, gets taught; tests at a particular grade level have little impact on time or instruction in the subject at other grade levels: administrative support and oversight are necessary if vertical and horizontal alignment of content and instruction in science is a desired result; and teachers are willing to be held accountable for student learning if that learning is measured with multiple instruments that do not adversely affect the well-being of the child.

The most decided impact of this test has been at the fifth grade level. Clearly the amount of time spent on science has increased at this level. As suggested by McNamara, Stuessy, McNamara, and Quenk (1999), science has indeed become a priority at the fifth grade level with the implementation of the science TAKS. The effects on the lower grade levels, however, are less straightforward. Most teachers in grades one through four reported that they spend no additional time teaching science since the implementation of the test. Those that did report spending extra time credited the leadership of their principal as the determining factor. Particularly in the third grade, where reading and math are tested, and in the fourth grade, where writing is tested, teachers reported the pressure to concentrate more on these subjects - often choosing to reduce the time allocated to science by combining it with another subject or teaching it

for only half of the six weeks' period. Even with the implementation of the fifth grade science TAKS, despite the hopes of the Texas elementary teachers surveyed by McNamara, et al. (1999), science is not a priority in the lower grade levels. Tested subjects continue to receive the most curricular space, as suggested by McNeil (2000a) and Edigar (2001).

Based on the responses of the teachers from the lower elementary grades in this study, the implementation of the science TAKS has had little effect on their instructional strategies in science. Those teachers who emphasized hands-on activities prior to the implementation of the test still do so now. Teachers who emphasized paper/pencil tasks prior to the test still teach using this method. The implementation of the science TAKS has not acted as the "agent of change" predicted of such high stakes tests by DeMoss (2002) or McGeehee and Griffith (2001). Teacher preference is the primary determining factor for the way in which science is taught at these grade levels. Particularly at the lower grade levels, the teachers' desire for adequate science materials and quality professional development opportunities in science is evident, confirming the conclusions of McNamara, Stuessy, McNamara, and Quenk (1999) and Jones, Jones, and Hargrove (2003).

At the fifth grade level, the science TAKS does indeed drive the instructional methods chosen by the teachers. Science is a priority, and the teachers do feel the pressure to keep their scores up to achieve the higher state ratings. Their choice of instructional method, however, varies - seemingly dependent on whether they adopt a "ratings-based response" or a "reform-based response" (Sloan, 2005). Those teachers

who chose a reform-based response increased their use of hands-on, inquiry-based methods of science instruction. This study also indicates that this reform-based response, with its emphasis on hands-on, inquiry-based methods of instruction, resulted in higher average test scores for the students in the fifth grade as well as a greater enjoyment and engagement in science activities at that same grade level. The teachers choosing a reform-based response reported that their participation in professional development opportunities that emphasized journaling and inquiry methods of instruction greatly influenced their choice of instructional strategies. Those teachers who chose a ratings-based response increased their use of more paper/ pencil, TAKS-formatted materials. The teachers who chose this ratings-based response reported professional development had little to do with their choice of instructional strategies as they rarely attended any professional development opportunities in science.

In addition, echoes of the proficiencies movement and its effect on math education, as described by McNeil (2000a), can be heard in the science classroom. During this "proficiency era", math education began to focus more on computational / operational basic skills, rather than higher-order conceptual knowledge, in response to the contents of the standardized tests. Likewise, some science teachers currently respond to the implementation of the science TAKS by resorting to a method of instruction that involves more paper/pencil "drill and kill" activities (with their emphasis on vocabulary) rather than a hands-on, inquiry methodology that fosters higher-level thinking. The curriculum narrows, particularly at the fifth grade level, as teachers discard entire "love" units and the in-depth study of selected topics, and resort to the "mile-wide,

inch-deep" coverage of content they feel is required for success on the TAKS.

I was unable to find any written directions to teachers other than statements given during district-level meetings concerning the scope and sequence development and the creation of TAKS-formatted, six-weeks assessments in science at the fifth grade. Other decisions concerning science instruction are left to the campus administrators with vague, verbal instructions to "keep the scores up." Teachers view this as further evidence of the lack of priority for science education at the lower elementary grade levels. This lack of direction from the central administration also contributes to the "ratings-based" response of some of the fifth grade science teachers. As mentioned previously, the teachers basically perceive the message from the central administration as: teach what is tested at your grade level and increase student scores.

Scheurich and Skrla (2003) report that strong administrative leadership is of paramount importance if schools are to achieve success in today's high-stakes testing environment. As shown in this study, science instruction at the lower elementary level (first through fourth grades) is highly dependent on the type of administrative leadership at that campus. Unless the campus administration demonstrates strong leadership by providing science facilities and materials, requiring teacher participation in professional development based on hands-on, inquiry-based methods of science instruction, and supporting the development of horizontal and vertical curriculum alignment, most teachers continue to place science on the back burner.

This study also shows that teachers have no problem with accountability and standards, but are opposed to the pressures (and the resulting stress) on the students in

the current high-stakes testing environment. Instead, these teachers prefer the use of multiple criteria in order to assess student progress, a method of student evaluation strongly suggested by numerous researchers (Hamilton, Stecher, & Klein, 2002; Jones, Jones, & Hargrove, 2003; Valenzuela, 2005).

The adverse effects of high stakes testing on children in our schools have been reinforced. Kohn's (2000) prediction concerning the erosion of student/teacher relationships appears on the horizon as teachers express concern with the effects of economically disadvantaged students, ELL students, and special education students on the TAKS scores and passing rates in their classrooms. And perhaps most poignantly of all, the stress levels experienced by our children have been highlighted as we see children who become ill at the mere mention of a test.

The Significance of the Findings

I see this study as a guide to help illuminate issues for future policy decisions concerning science education. Whereas much research has been done on the effects of high stakes testing on reading, writing, and math instruction, little has been done in the area of elementary science due to the recent implementation of such tests for this subject. In addition, much of the research has dealt with the effects in urban schools. The rural setting where my research took place provides another angle from which to view the high stakes testing phenomenon and its effects on elementary science education.

The indication that quality science education requires a dedication to hands-on, inquiry-based learning has been well-documented (Lawson, et al., 1989). If we cannot avoid a high-stakes testing environment (and for now, it seems that we cannot), then the

indications that hands-on, inquiry-based science instruction leads to increased test scores at the fifth grade level, and greater enjoyment and engagement in science activities at that grade level is of great significance.

The clear linkage of administrative leadership and science instruction at the lower elementary grade levels is of significance as well. This study highlights the need for strong campus and district leadership in the provision of lab facilities and science materials at the elementary level; sustained, content-based professional development that emphasizes hands-on, inquiry methods of science instruction; and the horizontal and vertical alignment of the science curriculum. Without these provisions, it appears that science education will continue to be placed on the back burner in the lower elementary grades.

I also propose that the "face" which I chose to put on this research by utilizing the narrative inquiry methodology to tell the stories of these teachers has provided a more personalized and "humanized" view of the effects of high stakes testing on science education and the children we teach.

Suggestions for Further Study

Theresa, the fifth grade teacher at Harrison, stated that she was able to correlate a student's readiness for / ability to do science in her class with the student's lower elementary science instruction. Further research, using a larger population of students, should be conducted to verify the connection between the effect of hands-on, inquiry science instruction at elementary grades and student readiness for science instruction in upper grades. Another study should be designed to develop an understanding of

individual fifth grade student knowledge about science to determine if that construction of knowledge is related to early grade instruction.

Numerous researchers have reported on the short term effect of high stakes testing on the emotional and psychological well-being of children (Kohn, 2000; McNeil, 2000a; Ohanian, 2002; Valenzuela, 1999). Several authors (Beiswenger, Stepans, & McClurg, 1998; Jorgenson & Vanosdall, 2002) have written that student choices to enroll in science at the high school and university level, as well as their career choices, can be traced to their early experience with science instruction. A longitudinal study that follows the children of this study through their high school would allow us to document their success in high school science classes as well as their choice of future careers.

The school-based leadership in the three schools where this research was conducted varied, from little emphasis on science instruction at Lone Pine to a concerted effort to encourage hands-on, activity-based science instruction at Clarksville. Teachers' perceptions of the importance the principal placed on teaching science affected the time they allocated for instruction in science. A study should be conducted to determine principals' and other district administrators' valuing and commitment to science instruction and how science instruction is seen as contributing to campus rating success. A study of the perceptions of staff-development personnel and curriculum directors would also be a valuable addition to the literature.

Epilogue: A Personal Perspective

And so I come to the end of my research study . . . or perhaps the beginning. For every question I may have answered, more arise. From my current vantage point, I see

my original conviction in the benefits of the implementation of the science TAKS in fifth grade as somewhat naive. I was sure that this would be the best thing that ever happened to science education. For the first time, science would receive the same emphasis that had always been placed on reading and math. Elementary schools would begin to spend money on labs and supplies to enhance science instruction - we were on our way.

Two years later, with a pilot study under my belt, my resultant one hundred and eighty-degree turn in the other direction now seems equally ill-considered. Yet I was convinced by that time that the science TAKS implementation was the *worst* thing that had ever happened to science education. Teachers were turning completely to paper/ pencil tasks. Students were learning to hate science at a younger and younger age. What had we done?

I now see the current state of science education (at least in this small cluster of schools) as more complex than either of these views - not really somewhere in the middle of that "love it / hate it" continuum, perhaps not even lying along that continuum "line" at all. I have seen how leadership styles affect school structure and science education in our TAKS environment. I've seen the possible benefits of the implementation of the science TAKS under the right tutelage, with teachers giving sufficient time for science and frequent hands-on, inquiry-based activities. However, I find that I cannot accept these benefits while ignoring the side effects inherent in the high-stakes testing system, many of which deal with the welfare of the child.

My central question remains: What goal is of most worth? If we want

imaginative, creative children who love science (and learning in general) - who think outside the box - who are excited and fascinated by their world and the wonders in it . . . then the current testing system might not be the solution. If we want "cookie-cutter" children who do what they are asked, learn what they are told, get good test scores, and ask for four multiple-choice possibilities for the answers to life's questions . . . then maybe we're on the right track. Perhaps I'm creating a dichotomy where none exists, but I don't believe so.

My third grade daughter loves science. I watch her as she avidly reads science books, asks for science kits for Christmas, begs to go to the science museum . . . and spends sleepless nights before "testing days", crying because she's afraid she won't do well. She's nine years old. As a principal from another school district commented not long ago, "We are resting the weight of the world on the shoulders of babies." I can only pray that my daughter has teachers in the future who truly care about her as an individual, who help her to experience the "pure joy of learning." And I pray after all is said and done, after all of the tests she must take over the next few years are completed, that she will still have that same love for science.

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