1-1-2001

Perceptions of standards-based reform and the role of instructional leadership

Robert Bruce Anderson
University of Nevada, Las Vegas

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PERCEPTIONS OF STANDARDS-BASED REFORM AND THE ROLE OF INSTRUCTIONAL LEADERSHIP

by

Robert Bruce Anderson

Bachelor of Science
State University of New York, College at Fredonia
1993

Master of Education
University of Nevada, Las Vegas
1997

A dissertation submitted in partial fulfillment of the requirements for the

Doctor of Education Degree
Department of Educational Leadership
College of Education

Graduate College
University of Nevada, Las Vegas
December 2001

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The Dissertation prepared by

Robert Bruce Anderson

Entitled

Perceptions of Standards-Based Reform and the Role of Instructional Leadership

is approved in partial fulfillment of the requirements for the degree of

Doctor of Education

[Signatures]

Examination Committee Chair

Dean of the Graduate College

Examination Committee Member

Graduate College Faculty Representative
ABSTRACT

Perceptions of Standards-based Reform and the Role of Instructional Leadership

by

Robert Bruce Anderson

Dr. Patti L. Chance, Examination Committee Chair
Assistant Professor of Educational Leadership
University of Nevada, Las Vegas

The purpose of this study was to increase the knowledge about science teachers' and principals' perceptions regarding science standards-based reform efforts in Nevada. The intent of the Nevada Education Reform Act (NERA) was to improve teaching and learning by impacting the following categories: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, and (f) supervision. The study investigated science teachers' and principals' perceptions of how standards impacted these areas as well as the role of instructional leadership in the implementation of standards-based reform. Finally, the study investigated how perceptions differed based on school size.

This study employed what Creswell (1994) called a dominant-less dominant design (p.177). In this study both quantitative and qualitative methods were used via a questionnaire and interview. The population for this study was all Nevada public high school (grades 9 -12) science teachers and principals.
These participants were both men and women who are currently employed in a Nevada public school. Using the Nevada State Department of Education (Nevada Department of Education, 2000), the population consisted of 425 science teachers and 130 principals, representing 65 public secondary high schools. From this population, 195 science teachers and 56 principals responded.

This study found principals and science teachers' perceptions significantly differed regarding the impact of Nevada science standards on (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, and (f) supervision. This suggested that principals and science teachers operate from different frames of reference within a school. In addition, the study found that state-mandated accountability measures curtail innovative teaching practices and hamper real instructional change. These accountability mandates have placed undue emphasis on compliance with bureaucratic rules and regulations rather than changing and improving instructional practices within the classroom.

As indicated by questionnaire and interview data, principals perceived themselves as instructional leaders, but practice these behaviors in a piecemeal or a "to do" list rather than approaching instructional leadership in a holistic way. Furthermore, the study found that perceptions differed based on school size. This supported Wright's (1991) notion that instructional leadership is complex and fragmented, especially at large schools.
In memory of
my grandparents

Bruce and Helen Smith
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ACKNOWLEDGMENTS

By finishing this dissertation, I feel a great sense of relief and personal accomplishment, but it would be foolish to think that I completed this task by myself. Many other individuals either directly or indirectly assisted me with this project. To these individuals, I owe a great deal of gratitude and thanks. Unfortunately, words alone cannot fully express these feelings, but I will attempt my best.

I would like to thank my wife Christine. Over the past three years, she has contributed so much to this study. From listening to ideas to listening to me complain, her encouragement and support has made the completion of this research study possible. I never could have wished for a better best friend, confidant, and wife. Thank you.

I would like to thank Dr. Patti L. Chance, chairperson, for her wisdom, insight, and support. Even with many other obligations and responsibilities, Dr. Chance always found time to listen and help. Dr. Chance embodies what it means to be a teacher. Thank you.

I would like to thank my friends and colleagues Mr. Matt Haskell, Ms. Michelle Sonnelitter, Mr. Scott Panik, and Mr. Bret Sibley for all the laughter and friendship. Additionally, I must thank Matt and Michelle for their input and suggestions over the course of this project. Thank you.
I would like to thank Dr. James Crawford, Dr. Carl Steinhoff, and Dr. Porter Troutman, the doctoral committee, for their assistance, effort, and time assisting the completion of this research study. Thank you.

I would like to thank all the participating science teachers and principals who donated their time providing data, making this study possible. Truly, teaching is the noblest of all professions, but the least appreciated. Thank you.
CHAPTER ONE

INTRODUCTION

Background of the Study

In the United States, major reform cycles have constituted a recognizable dimension in the educational landscape (Murphy & Adams, 1998). Ponder and Kelley (1997) noted that there has been a persistent perception that science education in the United States is in a state of crisis. From the conclusion of World War II, the rationale for science education reform has had many impetuses. These motives included providing trained scientists to combat the Soviet threat, producing better scientists for global economic markets, and producing higher academic achievement among all students (Murphy & Adams, 1998). The current reform period, dubbed the “excellence era,” beginning in 1983, has promoted policies intended to enhance student learning (Murphy & Adams, 1998, p.426). The initiating event for this “excellence era” was the publication of A Nation at Risk (National Commission on Excellence in Education, 1983) that according to Marzano and Kendall (1997) ushered in the modern standards movement.

The publication of A Nation at Risk (National Commission on Excellence in Education, 1983) contained the warning “the educational foundations of our
society are presently being eroded by a rising tide of mediocrity that threatens our future as a Nation and a people" (p.3). Citing lower student achievement as evidence, A Nation at Risk (National Commission on Excellence in Education, 1983) implied that mediocrity had permeated all levels of education and academic disciplines, including science. Thus, the publication contained the warning that if the nation's public schools did not begin to produce better-equipped students the United States would lose to foreign competitors in the global economy. Wallinger (1997) reaffirmed indicators such as decreasing SAT scores and declining scores on norm-referenced tests and international assessments implied that the United States had fallen behind its international competition.

Thus, proponents of this reform movement linked the financial security and the economic competitiveness of the nation to its educational system. Growing concerns about the educational preparation of the nation's youth prompted President George H. Bush and the nation's governors to have an Education Summit in 1989 (Marzano & Kendall, 1997; Tirozzi & Uro, 1997). Marzano and Kendall (1997) reported that the tacit purpose of this Education Summit was to motivate educators to set challenging standards within all major academic areas. Challenging standards aimed to improve academic achievement by establishing specific goals defining what students should know and be able to do by graduation (Raizen, 1998). This summit produced six broad National Education Goals. Congress, in 1994, added two more goals and
codified these goals with the passage of the Goals 2000: Educate America Act (Nerison-Low & Ashwill, 1999).

Two of these National goals related to specific academic achievement in science. They were: (a) U.S. students will leave grades 4, 8, and 12 having demonstrated competency in challenging subject matter, including science, and (b) U.S. students will be first in the world in mathematics and science achievement (National Educational Goals Panel, 1991). The Goals 2000: Educate America Act established support for voluntary, state-based systemic reform that included development and implementation of high academic standards in each state. Goals 2000 called for state plans for implementation and development of content standards in core subjects, student assessment linked through performance standards, and opportunity-to-learn standards. Goals 2000: Educate America also provided federal funding to states to support systemic state reform based on developed plans (Council of Chief State School Officers, 1995). Anderson (1996) asserted that National Education goals provided the impetus for National Science Standards. National science standards are a direct result of the perceived failure of science education to engage students and promote knowledge of science (Aguillard, 1998; Ponder & Kelly, 1997).

Responding to the Education Summit's call for standards, several professional organizations developed science education standards (Raizen, 1998). These groups included the American Association of the Advancement of Sciences (AAAS): Project 2061 that developed Science for All Americans and
Benchmarks for Science Literacy: the National Science Teachers Association (NSTA) that developed *Scope, Sequence, and Coordination of Secondary School Science*; and the National Research Council (NRC) that developed *National Science Education Standards*. These documents represent a set of coherent learning goals, enabling educators to help students achieve science literacy (Raizen, 1998).

These documents identified major scientific concepts and themes that students (grades K-12) should have achieved by the time a specific grade level has been reached. Each document has established as a goal that all students achieve scientific literacy (Raizen, 1998; Tirozzi & Uro, 1997). The National Research Council (1996) stated, "Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (p.22). The content defined in these standard documents exemplifies scientific literacy (NRC, 1996). Hence, these benchmarks will assist students in achieving greater scientific literacy while preparing them for the twenty-first century (Aguillard, 1998). It was argued that greater student understanding of science is critical to our nation immersed in an increasingly scientific and technologically oriented global economy and society (Bybee, 1997). It is paramount that our education systems produce students who have the capacity to assist in the technological development of our nation while understanding the basic principles that underlie scientific inquiry (Lederman, 1992). Consequences for students who do not fully understand the nature of
science include a lack of knowledge and critical thinking skills. Each is necessary to make individual decisions or social decisions about issues affecting one’s life in an increasingly scientific and technological world (Lederman, 1992; Meichtry, 1993). An adequate conception of the nature of scientific knowledge was recognized as an essential attribute if a scientifically literate individual is to result (Rutherford & Ahgren, 1990).

Based upon national standards, all states are in the process of adopting academic standards (Nerison-Lowill & Ashwill, 1999). At this time, all 50 states, including Nevada have adopted or have begun to adopt standards that serve as a foundation for the initiative to improve education (Nerison-Lowill & Ashwill, 1999). As local districts and schools redesign curriculum and instruction to meet the challenges of high standards in science, these state frameworks serve as a bridge and resource for decisions about scientific curriculum (Blank, 1996). Cross and Joftus (1997) reported that states are making the reforms necessary to help students meet the standards. These reforms include developing and administering assessments to measure student achievement, creating consequences to hold students and schools accountable for student achievement, and linking teacher education and professional development to these standards (p.12).

The Nevada legislature, during the 1997 and 1999 legislative sessions, enacted the Nevada Education Reform Act (NERA) to create standards that help to improve and to ensure high academic achievement among Nevada’s students (Nevada Department of Education, 2000). To facilitate this legislation, the
Nevada Council to Establish Academic Standards for Public Schools was established. NERA charged this council with the task of establishing high, measurable standards in all major content areas. Eric Anderson (personal communication, February 17, 2001), former Nevada K-12 Science Education consultant, stated that the council was appointed by Nevada's Governor, with input from the Speaker of the House, and Senate Majority Leader. Although one former educator was on the panel, as Anderson (personal communication, February 17, 2001) suggested, the Nevada Council to Establish Education Standards was constructed through political appointments.

Standards-driven reform requires change in how principals and teachers work. Anderson (1996) stated that the principal, as instructional leader, is to provide the necessary resources to ensure the achievement of academic goals. Principals, acting as instructional leaders, will be crucial if standards implementation is to be successful. Proponents of instructional leadership recognize that this concept is the primary vehicle for facilitating school learning and promoting new, innovative school practices such as the Nevada science standards (Boyd, 1990; Edmonds, 1982; Harris, 1998; Martin, 1990). Other scholars believe that principals influence student learning through their interaction with teachers and by shaping a school's organizational features (Hallinger, Bickman, & Davis, 1996). Anderson (1996) asserted that if principals are to guide acceptance of school science programs that reflect the vision of the state standards, principals must facilitate a climate that fosters shared responsibility for student success among students, teachers, administrators, and
parents. Assessment of curriculum and instruction will be ongoing to ensure both are continually updated and adjusted to achieve optimal learning for all students (Anderson, 1996). Cross and Joftus (1997) implied that for teachers, standards-base reform requires content knowledge, appropriate evaluation of all students, and focus on instructional improvement. As Boyd (1996) asserted, effective and high achieving schools are dependent upon capable instructional leadership from the principal. Fredricks and Brown (1993) suggested that instructional leadership is the crucial link between the principal's activities and the school's effectiveness.

Inger (1993) stated that current major educational reforms call for meaningful, extensive collaboration among teachers and administrators. This collaboration is the link between effective teaching and learning (Edmonds, 1982). School size may affect the implementation of Nevada science standards. In terms of instructional approaches, teachers in small schools are more likely to collaborate, to integrate disciplines, and to use alternative assessment (Cotton, 2001). Raywid (1999) stated that many researchers find instructional reform contingent on small school size and smaller schools are seen as more accountable. Anderson (personal communication, February 17, 2001) stated that in smaller school districts everyone knows what is occurring and that "a smaller unit could bring about change." (Anderson, personal communication, February 17, 2001).

Small school size does not guarantee success (Meier, 1996). Cotton (2001) stated that the term "small school" has no concrete numerical limit.
Research indicates that a small school is between 400-800 students whereas the range for large schools is 300 to 5,000 students. Lee and Smith (1996) indicated that the ideal small school size is between 600-900 students. Howley (1996) implied that although the definition of a small school varies, no definition recommends fewer than 300 students or more than 900 students for a school. Lee and Smith (1996) suggested that, for secondary schools, 900 students would be considered the maximum enrollment for a small school. Howley (1996) further added that the most suitable size is likely to vary from circumstance to circumstance.

School size may affect the impact of Nevada science standards. Wright (1991) inferred that instructional leadership is a difficult and a complex task to perform because it calls upon teachers and the principals to change. However, definitions of instructional leadership recognize that this concept is the primary vehicle for facilitating school learning and promoting new school practices such as Nevada science standards (Gersten, Carmine, & Green, 1982; Harris, 1998). Instructional leadership could be easier in a smaller school whereas instructional leadership is difficult at large schools due to the fragmentation and complexity of instructional leadership.

As Wright (1991) asserted, only a small amount of a principal's day is devoted to activities defined as instructional leadership. Wright (1991) further commented that one could begin to expand thinking beyond "the principal as instructional leader" to "the school staff as a team of instructional leaders" (p.117). The difficulties of fragmentation and complexity could be lessened if
more individuals were working to complete the tasks of leadership. Therefore, promoting a collegial atmosphere with teachers and delegating more responsibilities for organizational maintenance to subordinates, a principal may assume a more focused role as an instructional leader in a complex, fragmented school environment (Wright, 1991). In this fractured environment, Pajak (1993) and Sheppard (1996) stated that promoting professional development is the most influential instructional leadership behavior at the secondary level. Since NERA was adopted in 1998, principals and science teachers must have the ability to collaborate effectively in order to foster the implementation of science standards.

Statement of the Problem

Therefore, this study described secondary principals' and secondary science teachers' perceptions of Nevada science standards' impact on instruction, curriculum, assessment, accountability, professional development, supervision, and instructional leadership. In addition, the study described differences in perceptions among science teachers and principals at small, medium, and large schools.

Purpose of the Study

Standards-based reform in Nevada attempted to improve teaching and learning by impacting instruction, assessment, accountability, professional development, curriculum, and supervision practices in Nevada's schools. Fletcher (1998) raised the question about standards by asking, "will significant
changes follow in science classrooms?” (p. 2). An important step in addressing this question is to assess the perceptions that administrators and science teachers hold about science standards regarding the aforementioned areas.

In addition, for standards-based reform to be implemented successfully in Nevada, science teachers and principals must be engaged in the implementation. This implementation requires administrators to act as instructional leaders. Instructional leadership is the primary vehicle for facilitating school learning and promoting new school practices such as Nevada science standards. This study, therefore, sought to describe and to examine secondary principals' and secondary science teachers' perceptions of how Nevada science standards influenced instruction, curriculum, assessment, accountability, professional development, supervision, and the role instructional leadership played in the implementation. Furthermore, this study compared principals' and secondary science teachers' perceptions of how Nevada science standards influence instruction, curriculum, assessment, accountability, professional development, supervision, and instructional leadership at small, medium, and large schools in Nevada.

**Research Questions**

The study was guided by and attempted to answer the following questions:

1. How do principals and science teachers differ regarding their perceptions of the impact of Nevada science standards on
a. instruction,
b. assessment,
c. accountability,
d. professional development,
e. curriculum, and
f. supervision.

2. What are principals doing to implement Nevada science standards?

3. Are there differences in perceptions among science teachers and principals at small, medium, and large schools?

Population

The population for this study was all Nevada public high school (grades 9-12) science teachers and principals. These participants were both men and women who are currently employed in a Nevada public school. The population consisted of 425 science teachers and 130 principals, representing 65 public secondary high schools. These high schools were located in rural, suburban, and urban areas of the state. Due to the small number of high schools, the entire population was surveyed in the study. A random sample of three science teachers and three principals were interviewed.
Research Design & Methodology

This study's design utilized both quantitative and qualitative methods to obtain science teachers' and principals' perceptions regarding the impact of Nevada science standards on instruction, assessment, accountability, professional development, curriculum, supervision, and instructional leadership.

Quantitative methodology was employed to gain an understanding of science teachers' and principals' perceptions through the utilization of a questionnaire. The study employed qualitative methodology to gain knowledge from a selected group of principals and teachers. Creswell (1994) suggested that by combining quantitative and qualitative methods several advantages result such as data triangulation, complementary phenomena may emerge, one method informs the other, and mixed methods add scope and breadth to the study (p. 175).

Instrumentation

The researcher developed questionnaire used a Likert-type scale to obtain science teachers' and principals' perceptions about the impact of Nevada science standards on the classroom. Crowl (1996) and Gall, Borg, and Gall (1996) suggested that surveys are used extensively in educational research to collect information that is not directly observable. Through this method, one can learn about the opinions, activities, and future endeavors of respondents (Johnson, 1977). Crowl (1996) further asserted that surveys are used when the population under consideration is relatively large or dispersed over a large
geographical area. Thus, due to the geographical distribution and relatively large size of the population under study, a questionnaire was deemed most appropriate. In addition, questionnaires secure data at a minimum of time and expense (Miller, 1991).

The questionnaire items were derived from the definition of Nevada standards, Nevada Council to Establish Academic Standards for Public school goals, and instructional leadership concepts.

The Nevada Council to Establish Academic Standards indicated that their goal was to establish strong content standards that would form the cornerstone for strengthening Nevada's education system and ensuring that the education students receive is consistently strong across all of Nevada (Nevada Department of Education, 2000). This Council implied that Nevada's standards must be of the highest quality. These standards are to be clear, specific, rigorous, and measurable. They are to reflect important subject matter, balance knowledge and skills, potential for instruction, and research on student learning and development. The Council asserted the public, educators, and parents could support these standards (Nevada Department of Education, 2000).

Instructional leadership questions resulted from the literature review. Edmonds (1982) implied that instructional leadership is the link between effective teaching and learning. Moreover, Smith and Andrews (1989) defined instructional leadership as a variety of tasks: supervision, professional development, and curriculum improvement. Sheppard (1996) showed that professional development was the most influential component of instructional
leadership. Glickman (1985) indicated that integration of these concepts unites teachers' needs with school goals. Brookover and Lezotte (1979) viewed instructional leaders, in part, as evaluators of basic skill achievement. Blase and Blase (1999a) found effective instructional leadership consisting of two themes: talking with teachers to promote reflection and promoting professional growth. The majority of definitions of instructional leadership recognize this concept as the primary vehicle for facilitating school learning and promoting new school practices such as Nevada science standards (Gersten, Carmine, & Green, 1982; Harris, 1998). Through the literature, six common themes emerged common to instructional leadership: instruction, assessment, accountability, professional development, curriculum, and supervision.

Face and content validity (Gall, Borg, & Gall, 1996) for this questionnaire was established in two steps:

1. National instructional supervision experts Dr. Sally Zepeda, University of Georgia, Dr. Jeffrey Glanz, Keans University, New Jersey, and Dr. George Pawlas, University of Central Florida, examined the questionnaire to establish face and content validity and provide feedback.

2. A field test was conducted with a pilot group of principals and science teachers who were not a part of the final population (Fink & Kosecoff, 1998; Gall, Borg, & Gall, 1996; Henerson, Morris, & Fitz-Gibbon, 1987; Miller, 1991). The piloting of the questionnaire was completed at Green Valley High School, Henderson, Nevada. Green Valley High School is a comprehensive, secondary public high school with an enrollment of 3,250.
students. When the questionnaire was completed, the researcher received the pilot-respondents input on the instrument. A comment sheet was included with the questionnaire that assisted members of the pilot group to identifying questions that were difficult to understand or ambiguous, and provide feedback.

Once the population and questionnaire were finalized, the following process was used to mail the questionnaire to the members of the population. The stages included: (a) mailing an introductory letter that introduced the researcher and the research study to the principal of each school; (b) an initial mailing of the complete questionnaire with a cover letter; and, (c) telephone calls were made to each non-responding principal along with another complete mailing of the questionnaire.

The principal was mailed a packet that includes a cover letter and twenty questionnaires. The principal was asked to complete one questionnaire, provide one questionnaire to the administrator who directly supervises science classrooms, and disseminate the remaining twenty questionnaires to science teachers. Instructions asked the school's principal to collect all completed questionnaires and return them in an addressed, stamped envelope (Gall, Borg, & Gall, 1996; McMillan & Schumacher, 1984). Participants, who indicated a desire by completing the appropriate section on questionnaire, were interviewed by telephone to collect desired additional data using semi-structured questions (Merriam, 1998; Spradley, 1980).
The results obtained from the mailed questionnaire were analyzed using descriptive statistics and measures of central tendency. Descriptive statistics are mathematical techniques for organizing and summarizing a set of numerical data that utilize measures of central tendency such as mean, median, mode, and measure of variability such as standard deviation, variance, and range (Gall, Borg, & Gall, 1996; Fink & Kosecoff, 1998; Johnson, 1977).

Semi-structured telephone interview questions were developed from the questionnaire results. Adding qualitative methodology to the study, served to strengthen the overall design of the study (Creswell, 1994; Gall, Borg, & Gall, 1996). Henerson, Morris, & Fitz-Gibbon (1987) added that questionnaires do not provide the flexibility of interviews and those individuals express themselves better orally than in writing.

Interviews were scheduled with each individual at a convenient time as indicated on the questionnaire. The interview allowed individuals further opportunity to expand upon questionnaire topics. Analysis of interview data was accomplished by domain analysis to reveal themes (Spradley, 1980). The pre-established domains included (a) instruction, (b) curriculum, (c) assessment, (d) professional development, (e) accountability, (f) supervision, and (g) instructional leadership. Tables were constructed that visualized event occurrences to establish a pattern or patterns. In addition, direct quotes were used to enhance questionnaire data. Spradley (1980) suggested that flow charts be used as a method to analysis qualitative data to create taxonomy of each domain.
Significance of the Study

Fletcher (1998) maintained that standards-based reform differs from past reforms due to its emphasis on systemic change. However, Fletcher posed a significant question: “Will change follow in the science classroom?” (p.2). To be successfully implemented in Nevada, standards–based reform efforts require both science teachers and principals to be engaged in the process. Cross and Joftus (1997) implied that for science teachers, standards-based reform requires content knowledge, appropriate evaluation of all students, and focus on instructional improvement. The link between these teaching requirements and student learning is instructional leadership (Martin, 1990).

Hence, for the successful implementation of Nevada science standards into Nevada’s high school science curricula, instructional leadership is essential (Anderson, 1996). Definitions of instructional leadership recognize that this concept is the primary vehicle for facilitating school learning and promoting new school practices such as Nevada science standards (Gersten, Carmine, & Green, 1982; Harris, 1998). NERA established standards that define teaching and learning outcomes in Nevada’s science classrooms. Edmonds (1982) asserted that instructional leadership is the link between teaching and learning. Instructional leaders, then, link Nevada science standards to teaching and learning outcomes in science classrooms. In doing so, Pajak (1993) and Sheppard (1996) stated that promoting professional development is the most influential instructional leadership behavior at the secondary level.
Inger (1993) stated that current major educational reforms such as Nevada science standards call for meaningful, extensive collaboration among teachers and administrators. Teachers are expected to collaborate to alter curriculum and pedagogy within subjects. Instructional leaders are to link curriculum and pedagogy changes with teachers (Edmonds, 1982). However, in large high schools, teachers tend to be isolated from one another (Wright, 1991). Stockard and Maybery (1986), examining the influence of instructional leadership impacting student achievement in small-scale and large-scale schools, suggested that instructional leadership in different ways at different school settings. If large schools provide a complex and fragmented environment as suggested by Wright (1991), alternatives to sharing leadership responsibilities should be explored to ensure that the principal is able to be an instructional leader. This study determined if perceptions among science teachers and principals' differ at schools of different sizes.

Overall, Blase and Blase (1999b) noted there have been few descriptive studies of instructional leaders and their impact on teachers and classroom instruction. This study will examine instructional leadership behaviors in the implementation of Nevada science standards. By describing effective instructional leadership behaviors, this study will contribute to the existing literature, scholarship, and dialogue. In addition, this study is significant for Nevada educational policy.

Implementation of Nevada science standards represents an investment of resources from the state government. The success of these standards resides in
science teachers and principals. It is germane to describe, then, the perceptions
that these individuals possess regarding Nevada science standards' impact on
science instruction, assessment, curriculum, accountability, professional
development, supervision, and instructional leadership. If principals' and science
teachers' perceptions reveal standards are not influencing science curricula and
classroom instruction as intended, the Nevada State legislature may wish to re­
examine methods by which it imposes such standards. In the future, state
resources can be used to find alternative reform strategies, methods, and
policies. If these standards are positively affecting Nevada's science
classrooms, this study will describe areas affected, providing information to direct
future standards-based reform efforts.

Delimitations & Limitations

Borg and Gall (1989) stated that the "weaknesses in educational research
can be attributed to the inadequacies of our measures" (p.183). Miller (1991)
reported that the following limitations associated with mailed survey techniques.
These include:

1. Response rates to most questionnaires do not generally exceed 50%
when conducted by private and relatively unskilled person; intensive
follow-up efforts are required;

2. Those who answer the questionnaires may differ slightly from non-
respondents, thereby biasing the sample; and,
3. Non-respondents become a collection of individuals about whom virtually nothing is known (p.141).

Issac and Michael (1989) further stated the limitations of survey methodology by stating the following:

1. Questionnaires only tap respondents who are accessible and cooperative;
2. Questionnaires often make the respondents feel special or unnatural thereby producing responses that are artificial;
3. Questionnaires arouse “response sets” that are prone to agree with positive statements or questions; and,
4. Questionnaires are vulnerable to over-rater or under-rater bias causing some respondents to give consistently high or low ratings (p.128.)

The interview also has limitations as a research tool (Borg & Gall, 1989). Henerson, Morris, Fitz-Gibbon (1987) implied that the oral responses given in interviews are time-consuming. These authors also indicated that the interviewer might unduly influence the respondent. The respondent may become worried about why they are being questioned, what they are expected to say, and how their responses will be interpreted (p.26).

Although the interview was arranged around respondent indicated schedule, Miller (1991) suggested that a phone-interview could catch an individual in another activity. These activities possibly distracted the respondent or caused feelings directed toward the research such as frustration, anxiety, and hostility that have may interfered with the interview.
The reliability of the educational measures is "...the level of internal consistency or stability of the measuring device over time" (Borg & Gall, p.257). The reliability of a survey questionnaire makes assumptions that differences in answers stem from differences among respondents rather than differences in stimuli to which respondents are subjected (Fowler, 1988). Thus, the wording of a questionnaire needs to be clearly understandable and unambiguous. Reviews of the questionnaire by field experts and a pilot test were used to develop a more reliable instrument.

The researcher is another added limitation to the study Gall, Borg, and Gall (1996) discussed that the researcher has an emotional stake in the outcome of the research, which may make this individual susceptible to bias. These biases can be manifested in many different ways such as making errors in sampling, selecting measures inappropriately, or scoring responses of the subject incorrectly. This researcher is a science teacher in Nevada who has been affected by Nevada science standards. Hence, every attempt was made to remain objective and unbiased by including frequent review of the study's methods by other researchers and checking for omissions or unconscious biases (Gall, Borg, and Gall, 1996). The generalizeability of this study is limited to principals and science teachers at the secondary level (grades 9-12) in Nevada.
Definitions

1. Content Validity: “Refers to the degree to which the scores yielded by a test adequately represent the content or conceptual domain that these scores purport to measure” (Gall, Borg, and Gall, 1996, p. 250).

2. Descriptive Research: “A type of quantitative research that involves making careful descriptions of educational phenomena” (Gall, Borg, Gall, 1996, p.372).

3. Nevada Science Standards: “Represent a common core for science curriculum throughout Nevada’s schools that describe what all students should know and be able to do in science as a result of their education” (Nevada Department of Education, 2000).

4. Instructional Leadership: Keefe and Jenkins (1984) described instructional leadership as “the principal’s role in providing direction, resources, and support to teachers and students for improvement of teaching and learning in the school (p.7). Broadly, instructional leadership is concerned with instruction, assessment, accountability, professional development, and supervision (Blase & Blase, 1999b; Bossert, Dwyer, Rowan, & Lee, 1982; Gantor, Daresh, Dunlap, & Newsome, 1999; Glickman, 1985; Pajak, 1989).

5. Principal: An individual holding a Nevada administrative endorsement currently employed as a principal or administrator in a Nevada secondary public school (Nevada Department of Education, 2000).
6. Science teacher: An individual holding a Nevada secondary school teaching endorsement in one of the following areas: biological science, general science, or physical science currently teaching in a Nevada secondary public school (Nevada Department of Education, 2000).

7. Face Validity: "A casual, subjective inspection of the test items to judge whether they cover the content that the test purports to measure" (Gall, Borg, & Gall, 1996, p. 250).

8. Supervision: "What school personnel do with adults and things to maintain or change the school operation in ways that directly influence the teaching processes employed to promote pupil learning" (Harris, 1985, p.10) through the observation of classroom teaching, analysis of observed data, and interactions with teachers (Tracy, 1995, p. 320).

9. Interview: "In qualitative research, a type of interview that is used to supplement the data that has been collected by other methods" (Gall, Borg, & Gall, 1996, p.771).

10. Curriculum: Wiles and Bondi (1998) stated that curriculum is a formal plan or organizational structure with a delivery medium" (p. 3).

11. Accountability: "refers to the academic performance of Nevada's secondary science students as measured by state mandated tests" (Adams & Kirst, 1999, p.463).

12. Professional Development: This concept is concerned with how teachers are helped to base their decisions on educational principles through
programs designed to prepare teachers to make these decisions and the support provided to teachers (Tanner & Tanner, 1995, p.619).

13. Assessment: The measuring of student performance by testing and then evaluating the results (Robinson & Craven, 1989) based on predetermined criteria aligned with instructional objectives (McTighe & Ferrara, 1998).

14. Small School Size: Lee and Smith (1996) stated that for secondary schools those with an enrollment of 600-900 students work best in terms of student achievement. For this study, any school with an enrollment of 900 students or less will be considered small.

Summary

National standard documents such as the National Science Education Standards (NRC, 1996) have benchmarked what the nation’s K – 12 student population should be able to do or know by the conclusion of certain grade levels. These documents have been the basis for the development of state science standards in the majority of the states. By an act of the Nevada State Legislature in 1997, high academic standards were mandated (Nevada Department of Education, 2000). These standards will be measured by state sponsored standardized tests. Thus, as well as demanding higher student achievement in Nevada, teachers and administrators will be held accountable for meeting these standards. However, Fletcher (1998) asked the question, “will significant changes follow in science classrooms?” (p. 2). An important step in addressing this question is to assess the perceptions that administrators and
science teachers hold about science standards as well as the possibilities of implementation.

Data will be collected using a mixed methodology approach (Creswell, 1994) – the Nevada Science Standards Questionnaire and telephone interviews. Quantitative data will be analyzed using descriptive and inferential statistics (Gall, Borg, & Gall, 1996) whereas interview data will be analyzed using domain analysis (Spradley, 1980).

After addressing the research questions, policy-makers may be able to determine the most effective course of action to achieve implementation (Fletcher, 1998). The affects of school size on instructional leadership will also be explored. If large schools provided a complex and fragmented environment (Wright, 1991), alternatives to sharing leadership responsibilities should be explored to ensure that the principal is able to be an instructional leader.
CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

In the United States, major reform cycles constitute a recognizable dimension in the educational landscape (Murphy & Adams, 1998). Ponder and Kelley (1997) noted that there has been a persistent perception that science education in the United States is in a state of crisis, evident by continual education reform efforts since World War II. From the conclusion of World War II, the rationale for science education reform has had many impetuses. These impetuses have included providing trained scientists to combat the Soviet threat, producing better scientists for the global economic markets, and producing higher academic achievement among all students (Murphy & Adams, 1998).

The current reform period, beginning in 1983, has been referred to as the "excellence era" that has been characterized by policies intended to enhance student learning (Murphy & Adams, 1998, p.426). The initiating event for this "excellence era" was the publication of A Nation at Risk (National Commission on Excellence in Education, 1983) that according to Marzano and Kendall (1997) ushered in the modern standards movement. This movement followed a change
in the notion of educational accountability commensurate with the movement's challenge to obtain better student performance (Adams & Kirst, 1999).

A Nation at Risk (National Commission on Excellence in Education, 1983) contained the warning that if the nation's public schools did not begin to produce better-equipped students the United States would lose to foreign competitors in the global economy. A Nation at Risk (1983) further contended, "our own unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competition throughout the world" (p.5) and warned "the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a nation and a people" (p. 5). A Nation at Risk cited the following as evidence of the decline in public education: (a) poor student performance on international tests, (b) declining Scholastic Aptitude Test (SAT) scores, (c) a steady decline in science achievement among the nation's seventeen year-olds, and (d) watered-down curricula. Wallinger (1997) reaffirmed that indicators such as decreasing SAT scores, declining scores on norm-referenced tests, and international assessments implied that the United States had fallen behind its international competition.

Wallinger (1997) commented that United States' students rank near the bottom in physics, chemistry, and biology when compared to their peers in other industrialized nations. In addition, U.S. students' exhibit low interest in science as early as elementary school; major corporations spend large sums in remedial science training of employees; and fewer students than ever major in science
and engineering (Wallinger, 1997, p.228). Ponder and Kelly (1997) found that 93% percent of U.S. adults were scientifically illiterate.

Proponents of this "excellence movement" (Adams & Kirst, 1998) reform movement linked financial security and economic competitiveness to the nation's educational system. Growing concerns about the educational preparation of the nation's youth prompted President George H. Bush and the nation's governors to have an Education Summit in 1989 (Marzano & Kendall, 1997). This summit produced six broad goals for education. Two of these goals related to specific academic achievement (National Education Goals Panel, 1991). The National Education Goals directly related to science academic achievement included the following: (a) U.S. students will leave grades 4, 8, and 12 having demonstrated competency in challenging subject matter, including science, and (b) U.S. students will be first in the world in mathematics and science achievement (National Educational Goals Panel, 1991).

Marzano and Kendall (1997) reported that the tacit purpose of this Education Summit was to motivate educators to set challenging standards within all major academic areas. Challenging standards were to improve academic achievement by establishing specific goals defining what students should know and be able to do (Raizen, 1998). Anderson (1996) asserted that the National Education Goals provided the impetus for National Science Standards. These national science standards are a direct result of the perceived failure of science education to engage students and to promote knowledge of science (Aguillard, 1998; Ponder & Kelly, 1997).
Reform proponents argued that greater student understanding of science is crucial to our nation, which is immersed in an increasingly scientific and technologically oriented global economy and society (Lederman, 1992). Reich (1990) urged that our nation produce students that have the capacity to assist the technological development of our nation while understanding the basic principles of scientific inquiry. Reich (1990) explained that there are consequences for students who do not fully understand the nature of science. These are a lack of knowledge and critical thinking skills. These skills are necessary to make individual and social decisions that affect one’s own life in an increasingly scientific and technological world (Lederman, 1992; Meichtry, 1992). An adequate conception of the nature of scientific knowledge is recognized as an essential attribute if a scientific literate individual is to result from science education (Rutherford & Ahgren, 1990).

Responding to the Education Summit’s call for standards, several professional organizations developed science education standards. These groups included the American Association of the Advancement of Sciences (AAAS): Project 2061 that developed Science for All Americans and Benchmark for Science Literacy, the National Science Teachers Association (NSTA) that developed Scope, Sequence, and Coordination of Secondary School Science, and the National Research Council (NRC) that developed National Science Education Standards. These documents represent a set of coherent learning goals that enable educators to help students achieve science literacy (Raizen, 1998).
These documents identify major scientific concepts and themes that students (grades K-12) should have achieved by the time a specific grade level is reached. Each document has established as a goal that all students achieve scientific literacy. Scientific literacy was defined by the National Research Council (1996) as "...the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (p.22). The content defined in these standard documents exemplifies scientific literacy. These standards contain benchmarks for learning. Aguillard (1998) implied that these benchmarks would assist students in achieving greater scientific literacy while preparing them for the twenty-first century.

Based upon national standards, states are in the process of adopting their own academic standards (Cross & Joftus, 1997). Fifty states, including Nevada, have adopted or have begun to adopt standards that serve as a foundation for the initiative to improve education (Nerison-Low & Ashwill, 1999). The federal government has passed legislation to facilitate these processes. The Goals 2000: Educate America Act established support for voluntary, state-based systemic reform that included development and implementation of high academic standards in each state. This legislation called for state plans for implementation and development of content standards in core subjects, student assessment linked through performance standards, and opportunity-to-learn standards. Goals 2000: Educate America also provided federal funding to states to support
systemic state reform based on developed plans (Council of Chief State School Officers, 1995).

As schools redesign curriculum and instruction to meet the challenges of high standards in science, these state frameworks serve as a bridge as well as resource for decisions about scientific curriculum (Blank, 1996). Cross and Joftus (1997) reported that states are making the steps necessary to help students meet the standards. These steps include developing and administering assessments to measure student achievement, creating consequences to hold students and schools accountable for student achievement, and linking teacher education and professional development to these standards (Cross & Joftus, 1997, p.12).

In Nevada during the 1997 and 1999 legislative sessions, the Nevada Education Reform Act (NERA) was enacted to create standards that help to improve and to ensure high academic achievement among Nevada's students (Nevada Department of Education, 2000). To facilitate this legislation, the Nevada Council to Establish Academic Standards for Public Schools was established. This council was charged with the task of establishing high, measurable standards in all major content areas. Eric Anderson (February 17, 2001, personal communication), former Nevada K-12 Science Education consultant, stated that the council was appointed by Nevada’s Governor, Speaker of the House, and Senate Majority Leader. Although one former educator was on the panel, as Eric Anderson (personal communication, February
suggested the Nevada Council to Establish Education Standards was constructed through political appointments.

However, standards-driven reform requires a change in the relationship between teachers and principals. Anderson (1996) stated that the principal, acting as an instructional leader, is required to provide the necessary resources to ensure the achievement of academic goals. These instructional leaders are crucial if science standards are to be successfully implemented. Definitions of instructional leadership recognize that this concept is the primary vehicle for facilitating school learning and promoting new school practices such as the Nevada science standards (Gersten, Carnine, & Green, 1982; Harris, 1998).

Anderson (1996) further asserted that principals guide acceptance of school science programs, which reflect the vision of the state standards. In doing so, principals facilitate a climate that fosters shared responsibility for student success between students, teachers, administrators, parents, and the community. Continual principal assessment of curriculum and instruction is required to ensure that both are updated and adjusted, achieving optimal learning for all students (Anderson, 1996). Cross and Joftus (1997) implied that for teachers, standards-based reform requires content knowledge, appropriate evaluation of all students, and focus on instructional improvement. As Boyd (1996) asserted, effective and high achieving schools are dependent upon capable instructional leadership from the principal. Fredricks and Brown (1993) suggested that instructional leadership is the crucial link between the principal's activities and the school's effectiveness. Other scholars believe that principals
influence student learning through their interaction with teachers and by shaping a school's organizational features (Hallinger, Bickman, & Davis, 1996). However, principal leadership is essential if standards are to be successful.

History of Science Curriculum Reform: World War II to the Present

The role of general education in American society has changed considerably since the conclusion of World War II (Ponder & Kelly, 1997). War preparation revealed several deficits in American society. For example, military aptitude tests revealed many people deficient in basic literacy and quantitative reasoning skills (Garrett, 1995). This resulted in a shortage of trained personnel needed to fill scientific and technical fields. (DeBoer, 1991). Overall, World War II illustrated how important science, mathematics, and technologies were to a successful military effort (DeBoer, 1991; Garrett, 1995).

In the years following World War II, direct competition with the Soviet Union for international influence and military supremacy manifested in American schools by an increase in the level of science, mathematics and technical education provided (DeBoer, 1991). In response to the increased emphasis placed on science and responding to the shortage of trained scientists, President Harry Truman, in 1946, created the President's Scientific Research Board. The President's Scientific Research Board was charged with studying and reporting on the nation's research and development activities and on science training programs (DeBoer, 1991). This board recognized the importance of providing a general science education for all students (K – 12) and beyond. The President's...
Scientific Research Board suggested that focus on science education would stimulate an interest in science among students, thereby increasing the number of potential scientists and most important, providing a general science education for all students impacted research efforts. The continuation of scientific research in the U.S. depended on the support and understanding of the wider nonscientific population (Bybee, 1997; DeBoer, 1991).

Although science for general education purposes had long been a goal of secondary schools, this approach to science education had its critics (DeBoer, 1991). DeBoer (1991) noted that science education was directed at training the future specialist, consisted of specialized fields, and did not make connections to the general student. It was recommended that nonscientists be taught science principles through a study of historical development (Conant, 1947). This new approach aimed to develop an understanding of scientific processes and human aspects of science among the non-scientist. General science education came to mean an appreciation of the way science is conducted. The American Association for the Advancement of Science (AAAS) advocated general science courses to meet these goals as well as courses to allow gifted students to pursue their talents in science (DeBoer, 1991).

According to Garrett (1995), as the 1950s progressed, problems with United States science education persisted. The nation faced continued science personnel shortages, perceived threats to national security by the Soviet Union, shortage of science teachers, and low enrollment in science courses. DeBoer (1991) and Garrett (1995) implied these problems were caused by a variety of
reasons, but the blame was placed on curriculum and science teachers. By the mid-1950s, with National Science Foundation (NSF) financial support, professional organizations began to investigate methods that would bring renewed intellectual vigor to school science programs. During this period, the Soviet Union was investing heavily in science and technology, and their perceived superiority in these areas frightened many in the U.S. (DeBoer, 1991). However, the 1957 orbiting of Sputnik exasperated these fears and increased the national interest in science education. Interest in science education focused on regaining technological superiority. Moreover, an improved educational system was seen as a mechanism for competing with the Soviets (Bybee, 1997).

After Sputnik's launching, federally sponsored science curriculum reform programs were developed. Sputnik contributed directly to the passage of the National Defense Education Act of 1958 (Bybee, 1997). Because of federal funding, science curriculum focused on the logical structure and the process of science (DeBoer, 1991; Montgomery, 1994). The scientific community and federal government attempted to reassert American scientific superiority and to combat the Soviet threat by changing the science curriculum offered in K-12 schools. Immense discipline projects such as the Physical Science Study Project (PSSC), Biological Science Curriculum Study (BSCS), and Chemical Education Materials Study (CHEM study) were developed to propel American science education (Ponder & Kelly, 1997). These resulting new curriculum courses in biology, chemistry, and physics shaped science education for the following decade (Bybee, 1997; Garrett, 1995; Montgomery, 1994).
This new curricula presented science as a logically structured area of human investigation that candidly dealt with scientific research while encouraging students to think and act like scientists during research. However, Hurd (1970) implied that these courses failed to consider fundamental principles of curriculum and instruction. These new courses did not take into account the importance of student interest, relate student knowledge to student learning, or take into consideration children’s development. In conjunction, these projects possibly ignored providing individuals with knowledge and skills that would assist them in becoming scientifically literate (Hurd, 1970).

In the single decade between 1965 and 1975, American education entered and abruptly left a new period of major reform (DeBoer, 1991; Montgomery, 1994). Attention refocused from concerns about the Soviets to concerns about providing equitable and humane educational environments for all American youth. The appropriation of money to fund federal programs like Operation Head Start, Vocational Education Act, Elementary and Secondary Education Act, and policies on poverty and drugs impacted schools (Pajak, 1993). Montgomery (1994) inferred that this change had its roots in the Vietnam War and the Civil Rights movement. These social events served as a catalyst that aroused discontent and anger among American people. Curriculum advances reflected this change. The calls for rigor and excellence during an earlier decade appeared anachronistic (DeBoer, 1991). The emphasis in science education shifted from training future scientists and providing technical workers to emphasizing individual equality and opportunity (Bybee, 1997).
Gallagher (1971) argued that the new curriculum projects took a limited view of science, focusing primarily on conceptual schemes and processes in science. Gallagher urged that students become familiar with the social interactions of science as well as the structure of the discipline itself. Science education, instead of solely focusing on conceptual schemes and processes, now advocated that learners become familiarized with the social and technological interactions of science within science (DeBoer, 1991).

This change required that the science curriculum should be relevant to the lives of a broad range of students, not just those planning on careers in science (Gallagher, 1971). Cremin (1990) called this the popularization of education. DeBoer (1991) and Montgomery (1994) concurred that at this time instruction in science demonstrated a concern for the difference in ability and interest of each student. This increased attention to student interest and social relevance spawned the term "scientific literacy" (Ravitch, 1983). Scientific literacy describes the science education all school-aged children receive that is relevant to their lives life and to socially important issues. If students were scientifically literate, these students, as adults, could deal effectively with issues such as hunger, overpopulation, and energy shortages (Montgomery, 1994).

Scientific literacy gained additional prominence when a National Science Teachers Association (NSTA) position statement identified it as the most important goal of science education (DeBoer, 1991). DeBoer (1991) suggested NSTA's position statement contained the themes of social relevance, student interest, the relationships between science, and other curricula, science as a
human enterprise, and interdependence of science and technology. The goal of
science education was to teach those aspects of science that would assist
students in understanding science as well as to acquire intellectual tools for
deciphering new scientific knowledge in the future (DeBoer, 1991; Cremin, 1990).
Thus, the notion that science should be studied for its own sake was abandoned.

As the 1970s progressed, the term scientific literacy continued to be used
to express a wide range of educational goals. The relationship between science
and society evolved in the science curriculum under the rubric of a science-
technology-society (STS) theme (DeBoer, 1991). According to STS advocates,
science education in the 1980s was to be humanistic, value-orientated, relevant,
and socially concerned. However, Bybee (1997) suggested that schools were
Teaching more science, but with materials primarily designed for the academically
talented.

However, during the late 1970s, inflation had weakened the economy,
key industries struggled, the international standing of the United States had fallen
considerably, and Americans were the targets of criticism and terrorism abroad.
The faith in United States' institutions including schools began to be viewed with
distrust by the public (Montgomery, 1994). Society, during the 1970's, called into
question past values and ideas about the relationships between science, society,
and technology. The near disaster at Three Mile Island, in 1979, resulted in
decreasing public enthusiasm and support for funding science education (Bybee,
1997). STS issues increasingly gained public attention, but many made negative
connections between these issues and the need for better science education (Bybee, 1997; DeBoer, 1991).

The election of Ronald Reagan as President marked another shift as to how science education was to be viewed. At this time, the Cold War was still looming and Japan was viewed as a nemesis that threatened to overrun the United States with commercial goods (Bybee, 1997). Higher standards and basic skills were deemed necessary to reverse these trends (Boyd, 1990). A total return to academic priorities was required at all levels of education. Bybee (1997) contended that students were to be produced who were able to continue the wars of dominance in the economic, military, and ideological fronts. Montgomery (1991) argued that science was to be a source of power for America's survival. Not only was there a need for better science, but a more efficient and productive type of science was to be encouraged. Ponder and Kelly (1997) and Wallinger (1997) further reported that science education literature implied that science classes needed better science teachers.

Concurrent with these political changes were the warnings of A Nation at Risk (National Commission for Excellence in Education, 1983). Citing declining SAT scores and poor performance on international achievement tests, this document warned that “the educational foundations of our society are...being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people” (p.5). Thus, the American public had seemingly felt that the public schools were failing them (Chubb, 1988; Ponder & Kelly, 1997; Wallinger, 1997).
immediately resulted in a reform emphasis to a back-to-basic curriculum and more stringent graduation requirements (Cuban, 1990). Pipho (1986) reported that state reform activity emphasized two unifying themes: "more rigorous academic standards for students and more recognition and higher standards for teachers" (p. K5). Rigorous standards, according to Bybee (1997), included three years of science and mathematics, greater efficiency in the use of the school day, and a longer school day and school year. As the 1980s progressed, reform moved from this back-to-basic approach to reform emphasizing active learning, problem-solving, technology, and relevance (Odden & Marsh, 1987). Bybee (1997) suggested there was a call, again, for American students to be world leaders in science. However, this reform movement in science education was different from earlier reform movements. It was more vigorous, fueled by data from both national and international assessments, more penetrating, more pervasive, and more political (Adams & Kirst, 1998; Bybee, 1997).

In order to regain America's prominence in science, reports form organizations such as NSTA (1993) recommended curriculum changes for elementary, middle, and high school. The National Science Teachers Association provided recommendations about how to coordinate scientific ideas in the curriculum at different levels. Topic sequences for grades 6-8, 9-10, 11-12 were provided as a template to guide the design of a new curriculum (NSTA, 1993). Project 2061: Science for All Americans (AAAS, 1993) advocated the need for education to produce a scientifically literate society while urging
substantial and systematic changes in the traditional science curricula (Rutherford & Ahlgren, 1990). This project stimulated thinking and debate about science reform. Following this document, Benchmarks for Science Literacy (AAAS, 1993) was published, specifying how students should progress toward scientific literacy while recommending what students should be able to do at specific grade levels.

The most recent standard document, which is being used as a model for science curriculum reform, is the National Science Education Standards (NRC, 1996). These standards describe what all students should be able to do and understand because of their science education, offering a coherent vision to what it means to be scientifically literate. Thus, since the mid-1980's, tremendous attention has been focused on what students should know and be able to do as a result of K – 12 education (Marzano, Kendall & Cicchinelli, 1998)

Bybee (1997) inferred that in the past the science education community has done an excellent job with changing purposes such as producing more scientists to compete against the Soviets. Bybee (1997) further pointed out that the science education community has done an extremely poor job with the essential task of implementing the new programs and improving educational practices. Bybee (1997) further argued that science education is an interdependent system of teachers, principals, school personnel, and other science professionals. According to Bybee (1997) principals as supervisors were concerned with improving instruction while viewing the teacher as integral to the instruction process. An underlying assumption of the standard movement is that
good teaching is paramount to instruction and fulfilling the community's educational goals (Tracy, 1995).

Accountability and the Rise of National Standards

Beginning in the mid-1980s accountability issues increasingly revolved around the academic performance of schools: what and how much were students learning? (Adams & Kirst, 1998). The rise in quality concerns drove a new generation of education expectations and policies. The "excellence movement" was launched with the concept that educational accountability is commensurate with the movement's challenge for better student performance (Murphy & Adams, 1998).

From the mid-1980s through the 1990s, new demands for education accountability symbolized the nation's commitment to educational quality. At an educational summit held in 1989, President George H. Bush and the governor's of fifty states agreed upon six national educational goals for the United States to be achieved by the year 2000 (Nerison-Low & Ashwill, 1999). These goals created a framework for improving student achievement. With the passage of Goals 2000: Educate America Act, these goals were codified into legislation. This act established federal support for voluntary, state-based systemic reform that included the development and implementation of high academic standards. This legislation also supplied support for state-developed plans (Council of Chief State School Officers, 1995). The success of the Goals 2000: Educate America Act is perceived by proponents to be held within the hands of the local
community. Also, advocating a community's ability to initiate meaningful collaboration for the improvement of each individual school within its jurisdiction (Ellis, 1994).

The passage of this act supported new forms of educational accountability such as performance standards, performance accreditation, and high-stakes testing and value-added assessment. In addition, charter, contract, and magnet schools emerged to promote achievement and provide a means of accountability (Adams & Kirst, 1999). This new emphasis on standards demonstrated important shifts in the nature of public school accountability. This shift involved governors and state legislatures playing a more prominent role in education by driving policy. In addition, the states focused their role in public education by promoting higher standards for education through accountability systems designed to measure student achievement (Adams & Kirst, 1999; Sowell & Zambo, 1997). In 1996, the National Education Summit held by state governors and leaders of some of the nation's largest corporations and more than sixty-percent of the states agreed to set globally competitive science standards (Loucks-Horsley & Bybee, 1998).

Concurrent with the focus on student performance accountability, national science organizations such the National Academy of Science, the National Academy of Engineering, and the Institute of Medicine began to establish science goals for K-12 public school students (Aguillard, 1998). These national professional organizations began to create national standard documents that outlined what a student should know or be able to do by the time they have
reached or completed a certain grade level. The National Council for Mathematics published the first national math standards in 1989 while by 1996 the National Research Council had published the National Science Educational Standards for science curricula.

These voluntary national standards documents were meant to assist states and school districts in meeting performance standards that reflected the new direction in science education. Berger (2000) reported that many states are currently attempting to mandate local school districts start the standards-based process by adopting state standards or developing local content standards for core academic areas. Berger furthered argued that standards are needed to improve student achievement by clearly defining what is to be taught and what kind of performance is needed.

Nerison-Low and Ashwill (1999) reported that opinion polls are favorable concerning national goals in education, but the public remains divided on the need for formally defined national standards. Proponents of national standards argue that standards will encourage states to raise their own standards, provide students a common set of goals, improve school quality, and lead to greater equality between advantaged and disadvantaged schools (Berger, 2000; Nerison-Low & Ashwill, 1999). Opponents, however, suggest national standards detract from positive local reforms, set minimum standards, and lead to the establishment of a national curriculum, with federal government imposing top-down standards (p.21). However, Hurd (1988) suggested that curriculum reform needed to occur.
Hurd (1988) formulated that the traditional science curriculum was seen as producing students barely knowledgeable about the role of science and technology in their lives and in society's progress. Hurd (1988) implied that science curricula were devoid of critical thinking and application skills. Evidence from the National Assessment of Educational Progress in Science (NAEP) (National Center for Education Statistics, 1996) indicated that in 19 of 44 participating jurisdictions the average scale score for public eighth graders was higher than the national average while 14 performed below the national average. According to this indicator, many schoolchildren seem to lack the skills necessary to perform well on this achievement measure. Furthermore, A Nation at Risk (National Commission on Education, 1983) criticized the contents of science curriculum as being remote from human needs and social benefits, reflecting the concern that science is alien and separate from individuals and public interest.

Learning to think in science is the essence of scientific inquiry. Thinking, according to Clune (1998), is the essence of science along with inquiry, self-confident discovery, disciplined criticism, and cooperative problem solving. The consequences for students who do not fully understand science include a lack of knowledge and critical thinking skills. These attributes are necessary for one to make decisions about the issues that affect their lives in an increasingly scientific and technological world (Lederman, 1992; Meichtry, 1992). This nation needs to reevaluate its approach to science education (Hurd, 1988). Hurd (1988) signified that curricula needs to be developed that integrates time and events that consider the student's life today and tomorrow. The present view suggests that
there should be a core, or common, curriculum in science for all students, required at every grade level from kindergarten through at least grade level ten (Hurd, 1988).

National science education standards represent a new vision of science education. Fiske (1992) reported that Albert Shanker, past president of the American Federation of Teachers, argued that it is no coincidence that industrialized nations with superior school systems have well defined national standards. As the excellence movement continues, policy makers, business and school leaders, and researchers described conditions that illustrate the need for performance-based accountability commensurate with standards (Adams & Kirst, 1999).

Performance-based accountability needs to be a part of the vision that principals and science teachers share. The principal’s task is to evolve a comprehensive reevaluation and reorganization of the school’s science curriculum that develops a student’s capacity to deal with the realities of change, life long learning, and civic responsibility (Hurd, 1988). This will require a curriculum based on the relationship between human beings, natural phenomena, advancements in science and technology, and quality of life issues.

Based on lessons from the 1960’s two ideas emerged regarding science reform that became inherent to the national science standards movement:

1. the need to build a common vision about science education and coordinating activities around that vision, and
2. that reform is difficult to institute over a wide range of schools and school districts (Bybee, 1997).

International comparisons underscore this fact (Raizen, 1998). Nations such as France and Japan have effectiveness through centrally controlled education systems (Raizen, 1998). Most scientific research today is done collaboratively by teams. Team success depends as much on social qualities such as the ability to communicate and cooperate as it does on the science background of each investigator. Too often, activities that occur in the science classroom are individual and non-group orientated which to Hurd (1988) described the antithesis of the nature of scientific inquiry. Principals and science teachers need to seek a science curriculum framework that integrates the separate science disciplines and their connection with human society (Hurd, 1988).

To reach the national science education standards, educators must shed assumptions of the past. One such assumption is the best structure for a class period is a 45-minute lecture. This method has never led to a population with a high degree of scientific literacy. Louden and Hounshell (1998) stated that standards support student inquiry. Inquiry is the method for achieving greater understanding of science concepts and practicing investigative skill. Instructional activities should be tied to ongoing scientific enterprises in the community. Science would be treated less as an end in itself than as a field related to other aspects of life (Louden & Hounshell, 1998). Instructional emphasis would be placed on the power, responsibilities, and limitations of science (McNeil, 1990). Standards emphasize occurrences in the classroom such as curriculum...
development, instructional practices, student assessment, and professional
development for teachers (NRC, 1996). National Science Education Standards
(NRC) proposed that instead of viewing high school science courses as diluted
college science courses, high school courses should represent a common core

The purpose of standards documents are, in part, a reaction to the back-
to-basics movement which placed emphasis on testing basic skills to reinforce
the specification of curriculum guidelines in terms of measurable objectives
(McNeil, 1990). National standards advocate that average U.S. citizen should
understand enough science to deal in an informed manner with individual, family,
and community decisions regarding science, and ensure access to scientific
careers for all students regardless of gender, ethnicity, or socioeconomic status
(Raizen, 1998).

"This nation has established as a goal that all students should achieve
scientific literacy" (NRC, 1996, p. ix). Thus, the study of science as an
intellectual and social endeavor should have a prominent place in any curriculum
that has science literacy as a goal (American Association for the Advancement of
Science, 1993). Developing national science standards is an important and
complex undertaking. However, once developed, these standards do not
immediately influence the future (Loucks-Horsley & Bybee, 1998).

School science standards reflect the intellectual and cultural traditions that
characterize the contemporary practice of science. Moreover, science education
reform is a part of the systematic reform of American education (NRC, 1996, p.
There are several roots of education standards in science. Most notably these include current educational goals in the face of changing student body and the current conceptions of reform that emphasize systematic approaches and accountability mechanisms (Raizen, 1998). When the NRC standards were released in 1996, it was hoped that they would result in higher levels of science literacy for all the nation's students. These standards are a guide to the strategies, the structures, and the policies that support world-class science education. The standards specify teaching, assessment, professional development programs, and system standards, and most important, standards identify content that provide a set of ambitious learning goals for all students (Loucks-Horsley & Bybee, 1998; Sheldon & Biddel, 1998).

Before the advent of national science standards, the typical U.S. science program discouraged real learning, not only in its emphasis on facts, but also in its structure which inhibited students from making important connections between facts (NSTA, 1993). The National Science Teachers Association further described science education as "a layer cake" (p. 2). For example, students study biology grades 9-10, then chemistry, and finish with physics. Little reference is given to prior science experience; this structure promotes rote learning of discrete, factual information (NSTA, 1993). The difficulties students encounter in grasping theoretical considerations without a foundation of experience deters many from pursuing more science. The NSTA suggested that it would take time for this methodology to be replaced and the reconstructing of science education to begin (p. 2).
Thus, several organizations have developed national science standards: American Association of the Advancement of Science (AAAS), National Science Teachers Association (NSTA), and the National Research Council (NRC) (Raizen, 1998). These three organizations have agreed to collaborate in producing one science standard document to emerge as the standards. Raizen (1998) reported that the NRC was to be responsible for establishing a broad set of standards, and finance the project; NSTA played a role in the developing of tools, guidelines, and training for standard implementation; and AAAS has been credited with setting a vision about future science education. However, the NRC has ultimately accepted the responsibility for developing these standards. The goals for National Science Education Standards (NRC, 1996) are

1. to educate students who are able to experience the richness and excitement of knowing about and understanding the natural world,
2. use appropriate scientific processes and principles in making personal decisions,
3. engage intelligently in public discussion and debate about matters of scientific technological concern, and
4. increase their economic productivity using knowledge, understanding, and skills of the scientifically literate person in their careers (p. 13).

Fletcher (1998) maintained that national standard projects such as the National Science Education Standards (NRC, 1996) differ from reforms of the past because of their emphasis on systemic change. These documents
proposed that there needs to be a restructuring of all aspects of the educational delivery system if this reform is to be successful and long lasting. These programs define the curriculum revisions that need to occur, but according to Fletcher (1998) the obvious question should be asked, "will significant changes follow in science classrooms?" (p. 2). An important step in addressing this question is to assess the perceptions that administrators and science teachers hold about science standards as well as the possibilities of implementation. After addressing this question, policy makers may be able to determine the most effective course of action to achieve implementation (Fletcher, 1998).

By the mid 1990s, whole political systems, at state and national levels, adopted student performance as the primary social objective of schooling in the United States (Adams & Kirst, 1998; Sheldon & Biddel, 1998). Elmore, Abelson, and Fuhrman (1996) asserted that 43 states were actively engaged in redesigning accountability systems to focus on student achievement at that time. These new accountability systems emphasized student performance as the crux of state and district governance. Adams and Kirst (1999) observed that in an ideal system, performance-based accountability focuses educational policy on teaching and learning. Wiles and Bondi (1991) envisioned principals acting as instructional leaders as the link between these goals and classroom instruction.

Standards in Nevada

Nerison-Low and Ashwill (1999) implied that national goals have produced dialogue among legislators, educators, and school board members throughout
the United States that is focusing on improving education standards for all
students. The dialogue, directives, and funding from the Goals 2000: Educate
America Act have led states such as Nevada to design science standards.
These standards serve as a guideline for developing assessment instruments to
monitor the school's progress toward high standards (Nerison-Low & Ashwill,
1999, p.21). In 1997, the Nevada legislature enacted legislation to begin this
task.

The Nevada legislature passed a major education reform bill, Senate Bill
482, known as the Nevada Education Reform Act (NERA), during its 1997
session. A major intent of this legislation was to create standards to help
improve academic achievement for Nevada's students. To accomplish this goal,
a panel known as the Nevada Council to Establish Academic Standards for
Public Schools was created. This council's goal was to establish strong content
standards to form the basis of Nevada's educational system, ensuring that the
education that students receive across Nevada is of highest quality (Nevada
Department of Education, 2000). The Nevada Council to Establish Education
Standards was appointed by Nevada's Governor with input from the Senate
Majority Leader, and the Speaker of the House (Eric Anderson, personal
communication, February 17, 2001).

In the NERA legislation, standards were defined as what children should
know and be able to do in particular subject areas at a particular time in their
education (Nevada Department of Education, 2000). NERA legislation also
suggested that standards provide a set of common expectations to guide
curriculum development, student assessment programs, teacher education programs, and professional development programs for practicing educators (Nevada Department of Education, 2000). In addition, NERA contended that standards allow parents and schools to hold students accountable for developing certain knowledge and skills. Standards similarly allow students and parents to hold school staffs accountable for the teaching and the learning that occurs in schools. Finally, standards create a vision for what we want and expect from our educational systems (Nevada Department of Education, 2000). With an increasingly complex and technologically sophisticated world, it is crucial the standards are raised that set higher expectations for our children (Nevada Department of Education, 2000).

The Nevada Council to Establish Education Standards (Nevada Department of Education, 2000) determined that science is the component of the school curriculum where student inquiry and discovery can develop and flourish. Science seeks to make sense of the natural world by describing the patterns empirically studied (NRC, 1996). Science is the basis for the design of technologies that solve real-world problems and occupies an increasingly important place in one's everyday life. As workers, most occupations involve science and as citizens, many social issues involve science and technology. The Nevada science standards are intended to provide a framework for preparing students for the future; schools, in particular, must prepare all students to be scientifically literate (NRC, 1996).
The Nevada Science Standards represent a common core curriculum throughout Nevada. These standards were a result of dialogue and consensus building among educators, scientists, industry representatives, and parents throughout Nevada about what all students should know and be able to do in science (Nevada Department of Education, 2000). The goals of science education in Nevada are that all students do the following:

1. Demonstrate the processes of science by posing questions and investigating phenomena through language, methods, and instruments of science;
2. Acquire scientific knowledge by applying concepts, theories, principals, and laws from life, physical, and Earth/space science;
3. Demonstrate ways of thinking and acting inherent in the practice of science and exhibit an awareness of the historical and cultural contributions to the enterprise of science; and
4. Demonstrate an ability to solve problems and make personal decisions about issues affecting the individual, society, and the environment (Nevada Department of Education, 2000).

The standards that were built from these goals, advocated that knowledge and process are both important areas of science. These standards were designed so curriculum designers and teachers are encouraged to build units of study that emphasize an interdisciplinary approach to science. Nevada science standards are intended to provide Nevada students with a rich, thorough, and varied science education and to prepare them for challenges, discoveries, and
the demands of life in the present century (Nevada Department of Education, 2000).

Supervision

Supervision is required for the implementation of Nevada science standards. Supervision is the process of overseeing the ability of people to meet the goals of the organization in which they work (Daresh & Playko, 1995). Supervision practiced by principals has evolved over the years to meet the needs and demands of individual school districts and an ever-changing society. However, Tracy (1995) proposed that the common thread in supervision practiced in schools today has the intent to improve instruction through the observation of classroom teaching, analysis of observed data, and interaction with teachers (p.320).

The emergence of supervision resulted from the increasing complexity of schools and a greater range of subjects offered. Pajak (1993) stated that when supervisory practices emerged, it was coupled with Fredrick Taylor’s (1947) scientific management principles: control, accountability, and efficiency. Taylor’s industrial paradigm, in part, advocated the standardization of school goals (Bybee, 1997). Bybee (1997) suggested this was due to a perception that schools were ineffective and inefficient. Supervision emphasized inputs (instruction) and outputs (student achievement) for improving teacher and student performances. Thus, Tracy (1995) indicated that supervision attempted to determine the most productive methods relative to student outcomes.
Throughout the 1930s, 1940s, and 1950s, the idea that supervision involved improving instruction gained acceptance (Sullivan & Glanz, 2000). However, during the 1960s a drastic redefinition of supervision occurred (Pajak, 1993). Pajak (1993) and Sullivan and Glanz (2000) contended this occurred due to the federal government's increased role in schools, increasing in the complexity of schools, and the institution of collective bargaining agreements. Supervision as inspection was no longer viable. The concept of supervision as leadership emerged that stressed new ways to influence and to facilitate school and instructional change (Sullivan & Glanz, 2000). From this, clinical supervision practices originated that has become the dominant approach to classroom supervision. Clinical supervision involves the practice of meeting with teachers, planning, observing, and meeting again with teachers to discuss strengths and weaknesses (Pajak, 1993). The premise, according to Sullivan and Glanz (2000) was that clinical supervision could improve teaching by a prescribed, formal process of collaboration.

In the 1970s, the concept of instructional leadership emerged, which represented a broader notion of supervision (Sergiovanni & Craver, 1980). At this point in time, supervisors were needed to be instructional leaders, not simply leaders. Sergiovanni and Craver (1980) defined a school leader as "the individual charged with tasks of directing and coordinating the group's activities necessary to achieve a change in goals" (p.267). Martin (1990) highlighted this by further adding "There is wide consensus among educators that effective leadership is a vital link for effective schooling and teaching..." (p. 1-2).
Effective supervisors are regularly involved in curriculum design and development. Involvement in these areas is viewed as critical for successful supervisory practice (Wiles & Bondi, 1991). Wiles and Bondi (1991) further maintained that supervisors are the link between desired ends of the curriculum and the delivered curriculum (p.116). Supervision is paramount to effective teaching practices, assisting teachers in meeting classroom instructional goals. Glatthorn (1987) suggested that an excellent curriculum would have little impact if it is not taught well or supported by supervision.

If new curricula are to be successfully implemented, the principal is essential to its success. Building principals, according to Bookbinder (1992) have three major roles: chief school administrator, operations manager, and instructional leader. It is within the role of instructional leader that reform, school improvement, and accountability depends (Murphy & Adams, 1998, p.430).

The Principal as Instructional Leader

Effective schools emphasize the role of a strong instructional leader present in schools (Arnn & Mangieri, 1988; Bossart, Rowan, Dwyer, and Lee, 1982, Lezotte & Jacoby, 1992). Wright (1991) maintained that based on common behavior references, one could conclude that instructional leadership and supervision are virtually synonymous in meaning and implementation. However, Harris (1998) showed that, although these definitions may be synonymous, most definitions recognize instructional leadership as the primary vehicle for facilitating school learning and promoting new practices. Campbell,
Cunningham, Nystrand, and Usdan (1990) pointed out that the primary role of a principal should be instructional leadership. Pajak (1993) surmised that instructional leadership goes beyond the tradition of reinforcing specific prescribed teacher behaviors and skills. Edmonds (1982) linked this component of leadership to effective schools. Asick (1984) concluded that without effective leadership there would be no effective schools.

Bossart, Rowan, Dwyer, and Lee (1982) asserted that effective principals are successful in each of the following four areas of leadership: (a) goals and production, (b) power and decision-making, (c) organization and coordination, and (d) human relations. An effective principal places emphasis on goals and production such as setting instructional goals and developing performance standards. These individuals are more powerful making decisions especially in the areas of curriculum and instruction and mobilization of support than their ineffective counterparts (Bossart, Rowan, Dwyer, and Lee, 1982). Effective principals devote more time to supporting, organizing, and influencing organizational goals. Bossart, Rowan, Dwyer, and Lee (1982) further maintained that effective principals recognize the needs and styles of teachers and assist teachers achieve their own goals. Furthermore, according to a synthesis of research on effective schools, Purkey and Smith (1983) found that strong instructional leadership was present in schools recognized as effective.

Additionally, Arnn and Mangieri (1988) and Purkey and Smith (1983) discovered that principals at effective schools placed priority on strong goal orientation, active assessment, strong focus on academic subject, and teacher-
initiated instruction (p.6). Arnn and Mangieri (1988) also added that effective principals emphasized the following teacher characteristics: involvement, effective communication skills, and modeling (Arnn & Mangieri, 1988). Lezotte (1994) reported that research studies at all school levels repeatedly identified instructional leadership as critical. Lezotte stated that, "leadership and effectiveness seem inextricably linked" (p.21). According to Lezotte, the principal decides how resources, time, and limited money are allocated. The principal determines praises or sanctions, sets priorities, creates climate and expectation, and recruits and socializes new teachers (Lezotte, 1994). Martin (1990) recorded that, "there is wide consensus among educators that effective leadership is the vital link between effective schooling and teaching..." (p. 1-2). Lezotte (1994) extended the notion that all effective school research studies on elementary, middle, and secondary levels repeatedly identify instructional leadership as critical.

Smith and Andrews (1989) defined instructional leadership as a multitude of tasks: supervision of classroom instruction, staff development, and curriculum improvement. Glickman (1985) and Pajak (1989) also conceptualized instructional leadership. Glickman conceptualized instructional leadership as five primary tasks: direct assistance to teachers, group development, staff development, curriculum development, and action research. Glickman showed that integration of these tasks unites teachers' needs with school goals. Pajak (1989) conceived of instructional leadership similarly, but asserted that planning, organizing, facilitating change, and motivating staff were crucial to instructional
leadership. Blase and Blase (1999b) found that effective instructional leadership consisted of two major themes: talking with teachers to promote reflection and promoting professional growth. Duke (1987) and Smith and Andrews (1989) added that effective instructional leadership characteristics include clear vision, setting goals, communicating goals, placing a priority on curriculum and instructional issues, acting as an instructional resource, and functioning as a resource provider. Brookover and Lezotte (1979) viewed principals of effective schools as aggressive instructional leaders and evaluators of basic skill achievement.

Boyd (1996) formulated that effective and high achieving schools are dependent on capable instructional leadership. Edmonds (1982) and Fredricks and Brown (1993) wrote that instructional leadership is the link between a principal and school effectiveness. Other scholars have proposed that principals influence student learning through their interaction with teachers and shaping the school's organizational features (Hallinger, Bickman, & Davis, 1996).

Bookbinder (1992) suggested that instructional leadership and school achievement are linked. When exploring the extent of a school principal's effects on reading achievement in a sample of eighty-seven United States elementary schools, Hallinger, Bickman, and Davis (1996) demonstrated that instructional leadership can indirectly effect student achievement through shaping the school's learning climate. Other studies have shown the impact of instructional leadership, although Blase and Blase (1999a) suggested more studies are required. However, these studies include Reitzug (1994) that study showed the
effect of instructional leadership on teacher's greater emphasis on practice, collegiality, and innovation implementation.

Sheppard's (1996) synthesis of existing studies indicated a strong, positive relationship between instructional leadership and the level of teacher commitment, professional involvement, and innovativeness. Sheppard pointed out that promoting a teacher's professional development was the most influential act of instructional leadership at both elementary and secondary levels.

Findley and Findley (1992) noted that many national reports have focused on school effectiveness. These authors have suggested that the analysis of these reports has shown that the principal is the essential individual who will give direction to whatever is done in the school. If, for example, excellence is to be achieved through language development, then it is the role of the principal as instructional leader to communicate this priority.

Blase & Blase (1999b) reported that several studies regarding principal-teacher interactions produced findings showing the influence that principal's instructional leadership has on classroom instruction. For instance, a qualitative case study of effective high school principals' influence on teachers indicated instructional leadership's impact on teachers' time on task, expectations for student achievement, and problem solving orientation (Blase & Blase, 1999b). Reitzug (1994) spoke of one principal who provided staff development, modeled inquiry, encouraged risk taking, and critique by wandering around the school facility. These behaviors, according to Reitzug (1994), led to teachers' greater critique of practice, collegiality, and innovation implementation.
Blase & Blase (1999b) admitted there have been few descriptive studies of instructional leaders and their impact on teachers and classroom instruction. However, most notably, Sheppard's (1996) synthesis of existing studies indicated a strong, positive relationship among effective instructional leadership behaviors exhibited by principals and the level of teacher commitment, professional involvement, and innovativeness. The behaviors Sheppard correlated with these effects on teachers included forming school-wide goals, supervising and evaluating instruction, protecting instructional time, supporting professional development sessions, monitoring student progress, and maintaining high visibility. Sheppard pointed out that promoting a teacher's professional development was the most influential instructional leadership behavior at both the elementary and secondary levels.

Pajak (1993) surmised that instructional leadership goes beyond the tradition of reinforcing specific prescribed teacher behaviors and skills. Pajak stated, like Sheppard (1996), that instructional leadership should emphasize staff development. Pajak (1993) implied that what is best described as instructional leadership is "helping teachers discover and construct professional knowledge and skills" (p. 318).

Blase & Blase (1999a) explored teachers' perceptions on principals' instructional leadership strategies, interactions, and their impact on a broad range of dimensions of classroom instruction. These authors observed that instructional leaders who practice the strategies of making suggestions, giving feedback, modeling, using inquiry, soliciting advice and opinions, and giving
praise had enhancing effects on teaching. These findings implied those effective approaches to instructional leadership and supervision should integrate many specific elements such as peer coaching, reflective discussion, and action research into a holistic method to promote professional dialogue among educators. Boyd (1996) found that high teacher satisfaction with their professional role depended on perceiving principals as instructional leaders. Of specific relevance to the instructional leader concept, was Boyd's conclusion that instructional leadership is an excellent method of obtaining greater teacher commitment when the principals are role models for instruction. Arguing that effective instructional leaders use a broad-based approach, Blase & Blase (1999b) formulated that these individuals integrate reflection and growth to build a school culture of individuals and shared examination of improvement.

Blase & Blase (1999a) suggested guidelines for prospective and practicing principals. These suggestions included openly and frequently discussing instruction with teachers, making suggestions and giving feedback, soliciting teachers' advice and opinions about classroom instruction, and developing a cooperative school climate. These authors further emphasized that effective instructional leaders are committed to more than establishing school improvement and reform, but are also enhancing professional community in schools. These leaders continue to support collaborative efforts among educators by supporting development of coaching skills and reflective conversations among educators. Blase & Blase (1999a) contended that broadly developed structural conditions must be in place where resources and support
for curriculum and professional development are present. Harris (1998) and
Fredrick and Brown (1993) corroborated this new paradigm by asserting that
supervision is a broad function that emphasizes teaching and learning by
devising approaches as well as a collaborative function with other school
personal.

Recognizing the potency of instructional leadership, Daresh (1991)
warned that too great a reliance on this concept as a panacea for education
should be avoided. Daresh argued that instructional leadership needed to be
conceived as an on-going process that takes place around schools; a proactive,
continuous approach to school improvement must be maintained. Hence,
Daresh (1991) viewed proactive administration as the central ingredient to
instructional leadership that is built on several fundamental characteristics. The
characteristics that collectively create instructional leadership are awareness of
personal beliefs, understanding organizations, sensitivity to alternative
perspectives, consistency of personal behaviors, and the ability to understand
people. These attributes to instructional leadership are to be formulated into the
total pattern of leadership behavior much like Blase & Blase's (1999a) holistic
approach. Daresh (1991) accounted for instructional leadership as neither a
neutral or reactive process, but a proactive process that changes people and
their organizations for the better. Others have argued with Daresh's assertion,
but also warned about the realities of instructional leadership.

Wright (1991) surmised that when hearing the phrase "principal as
instructional leader," many imagine a principal sitting at a desk where he is
identifying instructional programs and related problems, designing improvement
plans, identifying instructional leadership tasks, and determining the classroom
observation and conference schedule. Combining this perception of instructional
leadership with the notion that teaching and learning are the school's most
important activities, one should assume that an instructional leader spends most
of his/her time related to these two attributes (Wright, 1991). However, it is more
likely to observe principals spending small amounts of time on instructional
leadership. Wright revealed that fragmentation and involvement with the
complexities of change characterize instructional leadership.

Wright (1991) discussed several studies that documented high school
principals' views of the realities of supervision and instructional leadership.
These studies have shown what high school principals actually experience in the
exercise of instructional leadership as contrasted with preconceived images or
conceptual frameworks such as those discussed earlier. Martin and Willower (as
cited in Wright, 1991) found only 7.6 percent of principals performed tasks
concerned with academic achievement during a typical school day. The balance
of their time was devoted to the tasks of organizational maintenance such as
pupil control or/and extracurricular activities. Hence, instructional leadership,
according to these authors, was interspersed with other activities.

Wright (1991) inferred that instructional leadership is a difficult and
complex task to perform because it calls upon teachers and the principal to
change. Wright further commented that one could begin to expand thinking
beyond "the principal as instructional leader" to "the school staff as a team of
instructional leaders” (p.117). The difficulties of fragmentation and complexity could be lessened if more individuals were working to complete the tasks of leadership. Therefore, by promoting a collegial atmosphere with teachers and by delegating more responsibilities for organizational maintenance to subordinates, a principal may assume a more focused role as an instructional leader in a complex, fragmented school environment (Wright, 1991).

Mojkowski (2000) asserted that the task of watching curriculum implementation, an instructional leadership role, falls to principals. Nevertheless, Mojkowski stated that through research and experience substantial discrepancies often exist between the written curriculum and the one implemented by teachers (p.72). This statement supports Wright’s assertion that instructional leadership in schools is fragmented and complex; in such a school environment, instructional leaders have difficulties directing all their attention to teaching and learning.

Being a principal in a school is a complex task. The principal must address managerial tasks to ensure an efficient school, but the principal must be able to stay focused on activities that provide high student achievement, both academically and socially (Findley & Findley, 1992). Therefore, instructional leadership is crucial, but due to school realities it is often fragmented and complex (Wright, 1991). These complexities can be overcome by developing a community of instructional leaders and delegating responsibility to others to focus on achievement of students and the teaching of teachers. In order for this to occur, professional development must be emphasized. As Findley and Findley
(1992) pointed out, effective instructional leadership allows for professional
growth.

The instructional leader sets the tone and direction for change as well as acts as a facilitator and resource person. An instructional leader is not afraid to share the process for making an effective school with teachers and staff (Findley & Findley, 1992). The two most important components to school improvement as directed by an instructional leader are to promote professional development among faculty and to make any change effort a collaborative one that utilizes all parties (Findley & Findley, 1992).

Instructional Leadership and School Size

Howley (1994) discussed that over the past forty years, schools with thousands of students have become common. Howley added that the trend toward large school size originated with James Bryant Conant who in 1967 stated that larger schools (over 750 students) could offer a higher quality, comprehensive instructional program at lower costs than smaller schools. Howley (1996) suggested, however, that the earliest research literature about school size comes from a period prior to 1925. The justification for building larger schools and closing smaller ones were administrative and instructional.

The administrative motives dealt with economy of scale issues, implying that larger units can use staff and resources more efficiently. The instructional motives dealt with paying closer attention to education's effectiveness (Howley, 1996). Howley (1996) explained that during this trend toward larger schools,
optimal school size was examined. Research on the subject attempted to reveal the one-best size for public schools. Howley (1996) expressed that effects of school size are relative to the school's circumstances.

The relatively of school size was discussed by Friedkin and Necochea (1988) who suggested that a community’s relative poverty or affluence is a likely indicator of the ideal school size for that community. Friedkin and Necochea (1988) found that school sizes associated with high levels of student achievement are tied to the socioeconomic status of the community. Small schools are found to provide an achievement advantage for impoverished students, but affluent students may perform better in larger schools. Howley (1994) reported that generally larger schools have not produced greater academic success at a lower cost as initially intended. However, Howley (1994) cited evidence suggesting students in higher socioeconomic status communities perform better in large schools. Small size seems to benefit minority and low-income students more than middle- and upper-class students.

However, despite benefits to smaller school size, policymakers still employ a powerful rationale to justify the creation of larger high schools. The rationale is made that small high schools cannot provide a curriculum with adequate breadth and depth to meet students' diverse needs. Monk (1986) suggested that this criticism is exaggerated, stating that a total enrollment of 400 students is sufficient for the provision of adequate curriculum.

Schools in different areas face different sets of challenges. Rural schools are challenged by distance and topography where students, for example, endure
long, daily bus rides to school (Howley, 1996). Rural poverty dictates larger
schools sizes that may be educationally counterproductive. Howley (1996)
explained that urban schools face different challenges. In many communities,
changes in residential patterns have turned large, middle-class schools into
schools attended by impoverished students. These schools become
dysfunctional, providing education poorly to the community.

Lee and Smith (1996) illustrated that the majority of the nation's largest
high schools in urban areas serve a high concentration of disadvantaged
students; others have reported that larger school size hurts attendance and
dampens enthusiasm for school activities. Large schools have lower grade
averages and standardized tests scores, high dropout rates, violence, and drug
abuse (Klonsky, 1995). Klonsky (1995) stated large schools function like
bureaucracies whereas small schools function as communities. Klonsky (1995)
said that small school size encourages teachers to innovate and students to
participate, resulting in greater commitment. Small schools report higher grades
and tests scores, improved attendance rates, and lower dropout rates. Monk
(1986) noted that size presents an opportunity to provide an adequate
curriculum. To ensure that the curriculum is successful, a high school depends
on leadership. The small school threshold merely makes it easier for good
leadership to fulfill its responsibilities.

Cotton (2001) stated that the term "small school" has no concrete
numerical limit. Research indicates that a small school is between 400-800
students whereas the range for large schools is 300 to 5,000 students. Lee and
Smith (1996) indicated that the ideal small school size is between 600-900 students. Howley (1996) implied that although the definition of a small school varies, no definition recommends fewer than 300 students or more than 900 students. Howley (1996), agreeing with Friedkin and Necochea (1988), further added that the most suitable size is likely to vary from circumstance to circumstance. However, small school size alone does not guarantee success (Meier, 1996). Other factors that influence success at schools include collaboration between teachers and administrators. This collaboration is the link between effective teaching and learning (Edmonds, 1982). Sheppard's (1996) synthesis of existing studies on instructional leadership indicated a strong, positive relationship between instructional leadership and the level of teacher commitment, professional involvement, and innovativeness. In terms of instructional approaches, teachers in small schools are more likely to collaborate, integrate disciplines, and use alternative assessment (Cotton, 2001). Raywid (1999) stated that many researchers find instructional reform contingent on small school size and smaller schools are seen as being more accountable.

Findley and Findley (1992) discussed that the two most important components for school improvement as directed by an instructional leader is to promote professional development and collaboration efforts that utilize all involved parties. Pajak (1993) surmised that professional development is the most important aspect of instructional leadership. As Inger (1993) and Raywid (1999) implied this may be more easily accomplished at smaller schools. Inger (1993) noted schools, which foster substantial collegial relationships among
teachers, show significant improvements in student achievement, behavior, and attitudes.

Inger (1993) stated that current major educational reforms, such as Nevada science standards, call for meaningful, extensive collaboration among teachers and administrators. Teachers are expected to collaborate to alter curriculum and pedagogy within subjects. Instructional leaders are to link curriculum and pedagogy changes with teachers (Edmonds, 1982). However, in large high schools, teachers tend to be isolated from one another (Wright, 1991). Stockard and Maybery (1986), examining the influence of instructional leadership impacting student achievement in small-scale and large-scale schools, suggested that instructional leadership varies in at different school settings. Friedkin and Necochea (1988) described that good school climate and instructional leadership would be easier to achieve in small-scale schooling rather than large-scale schooling. Howley (1996) suggested that small schools could have a positive influence on student achievement. However, policy makers believe that large schools are more cost effective and more educationally efficient (Howley, 1996).

Inger (1993) stated that in large schools where teachers work closely together, they become more adaptable and self-reliant. Collectively, these teachers possess the energy and resources to attempt innovations. Teamwork promotes coherence in a school’s curriculum and instruction. This environment fosters continual teacher learning that enhances classroom effectiveness (Inger, 1993). However, Wright (1991) maintained that instructional leadership is often
fragmented and complex. Monk (1986) suggested that smaller schools are easier for good leadership to be successful. Thus, smaller schools may be less fragmented and complex than their larger counterparts. To support teacher collaboration at large schools, Inger (1993) suggested that there are six dimensions to making this possible: (a) endorsement and rewards, (b) school-level organization of assignments and leadership, (c) latitude provided for curriculum and instruction, (d) time, (e) training, and (f) material support. Wright (1991) noted the importance of collaboration among teachers and other administrators to share responsibilities, so the principal could be an instructional leader.

Summary

In the United States, major reform cycles constitute a recognizable dimension in the educational landscape (Murphy & Adams, 1998). Ponder and Kelly (1997) noted that there has been a persistent perception that science education in the United States has been in a state of crisis, evident by continual education reform efforts since World War II.

The current reform period, beginning in 1983, has been referred to as the "excellence era" that has been characterized by policies intended to enhance student learning (Murphy & Adams, 1998, p.426). Proponents of the "excellence movement" (Adams & Kirst, 1999) linked financial security and economic competitiveness to the nation’s educational system. Growing concerns about the educational preparation of the nation’s youth prompted President George H.
Bush and the nation's governors to have an Education Summit in 1989 (Marzano & Kendall, 1997), this summit produced six broad goals for education.

Anderson (1996) asserted that these goals provided the impetus for National Science Standards (NRC, 1996) represent a set of learning goals, enabling educators to help students achieve (Raizen, 1998). In Nevada during the 1997 and 1999 legislative session, the Nevada Reform Act (NERA) was enacted the create standards that help to improve and to ensure high academic achievement among Nevada's students (Nevada Department of Education, 2000). In order for standards-based reform to be successful, Anderson (1996) stated that the principal, as instructional leader, is required to ensure these goals are met. Fredricks and Brown (1993) suggested that instructional leadership is the crucial link between the principal's activities and the school's effectiveness.

Therefore, instructional leadership is crucial, but due to the realities of a school setting it is often fragmented and complex (Wright, 1991). School size effects student achievement and instructional leadership activities. In large high schools, teachers tend to be isolated from one another (Wright, 1991). Stockyard and Mayberry (1986), examining the influence of instructional leadership impacting student achievement at small-scale and large-scale settings, suggested that instructional leadership is dependent upon the school size. Friedkin and Necochea (1988) described that good school climate and instructional leadership would be easier in a small school setting.
CHAPTER THREE

METHODOLOGY

Introduction and Review of the Study

Murphy and Adams (1998) have dubbed the current era of education reform "the "era of excellence." The initiating event for this "excellence era" was the publication of A Nation at Risk (National Commission on Excellence in Education, 1983) that according to Marzano and Kendall (1997) ushered in the modern standards movement. A Nation at Risk (1983) contained the warning that if the nation's public schools did not begin to produce better equipped students, the United States would lose to foreign competitors in the global economy. Wallinger (1997) reaffirmed that indicators such as decreasing SAT scores, declining scores on norm-referenced tests, and international assessments implied that the United States had fallen behind its international competition. Reform proponents linked the financial security and the economic competitiveness of the nation to its educational system. Growing concerns about the educational preparation of the nation's youth prompted President George H. Bush and the nation's governors to have an Education Summit in 1989 (Marzano & Kendall, 1997; Tirozzi & Uro, 1997).

Marzano and Kendall (1997) reported that the tacit purpose of this Education Summit was to motivate educators to set challenging standards within
all major academic areas. The creation of challenging standards aimed to improve academic achievement that established specific goals defining what students should know and be able to do by graduation (Raizen, 1998). This summit stimulated several professional organizations to draft education standards in core academic areas such as science (NRC, 1996). At this time, all fifty states, based on or inspired by national standards, have developed state standards (Nowill-Low & Ashwill, 1999).

The Nevada State Legislatures, in 1997 and 1999, enacted the Nevada Education Reform Act (NERA) to establish high, measurable standards in Nevada's classrooms (Nevada Department of Education, 2000). As part of this legislation, Nevada science standards were developed for Nevada's science classrooms. If these science standards are to be successfully implemented in Nevada's science classrooms, the perceptions of science teachers and principals are an important indicator about the impact of Nevada science education standards. This study, moreover, determined if there are differences in perceptions among science teachers and principals at small, medium, and large schools.

To do so, both quantitative (mailed questionnaire) and qualitative (telephone interview) methods were employed to focus in on the phenomenon of interest to this study (Creswell, 1994). Creswell (1994) discussed successful combinations of survey research and qualitative procedures. Creswell (1994) and Greene, Carocelli, and Graham (1989) suggested that triangulation was an important reason to combine qualitative and quantitative methods. Additionally,
these researchers also purported that combined methodology may allow different aspects of a phenomena to emerge, one method could be used to inform the other, and a mixed design adds scope and breadth to the study.

Quantitative research methods utilize a positivist framework by collecting numerical data on behaviors of samples then subjecting these data to numerical analysis (Gall, Borg, & Gall, 1996, p.28). Positivist research is grounded in the assumptions that qualities of a social environment constitute an independent reality and are constant across time and setting (p. 28). In order to understand the causal connection among social phenomena, an instrument can be developed to measure these observable behavior manifestations.

Qualitative research methods utilize a post-positivist framework that is grounded in the assumption that features of the social environment are constructed as interpretations by individuals and that these interpretations tend to be transitory and situational (Gall, Borg, & Gall, 1996, p.28). Merriam (1998) stated that qualitative researchers “are interested in understanding the meaning people have constructed “(p.6). Thus, qualitative research implies a direct concern with experience as it is lived, felt, or undergone. It is assumed that meaning is embedded in peoples’ experiences and that meaning is mediated through the investigator’s own perceptions (Merriam, 1998). Qualitative methodology is concerned with understanding the phenomena of interest from the participants’ perspective, not the researchers.

The combination of methodologies designed to study the same phenomenon has been called triangulation (Creswell, 1994; Gall, Borg, & Gall,
1996; McMillan & Schumacher, 1984). This is the process of using multiple
data-collection methods, data sources, and analysts to check the validity of the
findings (p.574). Gall, Borg, and Gall (1996) reported that triangulation helps
eliminate biases that might result from relying exclusively on any one data
collection technique. McMillan and Schumacher (1984) further added that
triangulation involves different types of data to describe and analyze a
phenomenon. Qualitative and quantitative research can complement one
another by playing unique roles in the discovery and confirmation process.

Chapter 3 describes the procedures and constructs utilized to address the
problem statement identified in chapter one. Triangulation of the data was
achieved by using two different methods for collecting data germane to this
study. These were (a) a mailed survey questionnaire to Nevada secondary
(grades 9 – 12) principals and science teachers, and (b) semi-structured
telephone interviews with selected principals and science teachers as a means of
confirming the mailed questionnaire.

Statement of the Problem

Therefore, this study described secondary principals' and secondary
science teachers' perceptions of Nevada science standards' impact on
instruction, curriculum, assessment, accountability, professional development,
supervision, and instructional leadership. In addition, the study described
differences in perceptions among science teachers and principals at small,
medium, and large schools.
Purpose of the Study

Standards-based reform in Nevada attempted to improve teaching and learning by impacting instruction, assessment, accountability, professional development, curriculum, and supervision practices in Nevada's schools. Fletcher (1998) raised the question about standards by asking "will significant changes follow in science classrooms?" (p. 2). An important step in addressing this question is to assess the perceptions that administrators and science teachers hold about science standards regarding the aforementioned areas.

In addition, for standards-based reform to be implemented successfully in Nevada, science teachers and principals must be engaged in the implementation. This implementation requires administrators to act as instructional leaders. Instructional leadership is the primary vehicle for facilitating school learning and promoting new school practices such as Nevada science standards. This study, therefore, sought to describe and to examine secondary principals' and secondary science teachers' perceptions of how Nevada science standards influenced instruction, curriculum, assessment, accountability, professional development, supervision, and the role instructional leadership played in the implementation. Furthermore, this study compared principals' and secondary science teachers' perceptions of how Nevada science standards influence instruction, curriculum, assessment, accountability, professional development, supervision, and instructional leadership at small, medium, and large schools in Nevada.
Research Questions

The study was guided by and attempted to answer the following questions:

1. How do principals and science teachers differ regarding their perceptions of the impact of Nevada science standards on
   a. instruction,
   b. assessment,
   c. accountability,
   d. professional development,
   e. curriculum, and
   f. supervision.

2. What are principals doing to implement Nevada science standards?

3. Are there differences in perceptions among science teachers and principals at small, medium, and large schools?

Instrumentation

Gall, Borg, and Gall (1996) suggested that surveys are used extensively in educational research to collect information this is not directly observable. Many educational problems can be investigated by the use of such instruments. Johnson (1977) stated that the most common type of survey is the questionnaire that is normally mailed to a sample of individuals who record their responses, then mail back the questionnaire. A questionnaire can be used to learn about opinions, activities, and endeavors of the respondents (Johnson, 1977; McMillan...
& Schumacher, 1984). Growl (1996) implied that questionnaires are used to determine the distribution of variables that are difficult to observe. Growl further asserted that surveys are used when the population under consideration is relatively large.

A questionnaire was created consisting of seven demographic questions and forty-nine Likert-type scale items (appendix I – administrator and appendix II – science teacher), each describing a specific goal as defined by the Nevada Council to Establish Academic Standards for Public schools (Nevada Department of Education, 2000). These goals are as follows:

1. provide an important first step in improving the education that we provide our children;
2. provide a set of common expectations to guide curriculum development, student assessment programs, teacher education, and professional development programs for practicing educators;
3. allow parents and schools to hold students accountable for developing certain knowledge and skills;
4. allow students and parents to hold school staffs accountable for teaching and learning at their schools; and
5. create a vision for what we want and expect from our educational system.

Instructional leadership questions resulted from the literature review. A question matrix was developed that links each questionnaire item to an individual instructional leadership concept (appendix III). Edmonds (1982) implied that instructional leadership is the link between effective teaching and
learning. Additionally, Smith and Andrews (1989) defined instructional leadership as a variety of tasks: supervision, professional development, and curriculum improvement. Sheppard (1996) showed that professional development was the most influential component of instructional leadership. Glickman (1985) indicated that integration of these concepts unites teachers' needs with school goals. Brookover and Lezotte (1979) viewed instructional leaders, in part, as evaluators of basic skill achievement. Blase and Blase (1999a) found effective instructional leadership consisting of two themes: talking with teachers to promote reflection and promoting professional growth. Through the literature, six themes emerged common to instructional leadership: instruction, assessment, accountability, professional development, curriculum, and supervision. Each common theme is discussed.

Curriculum, according to Tanner and Tanner (1995), refers to the growing trend toward standardized achievement testing, resulting in curriculum being conceived in terms of test results. Thus, curriculum is the quantitatively measured outcomes of instruction. Instruction will be assessed by measuring student performance by testing and evaluating the results (Robinson & Craven, 1989) that are based on predetermined criteria aligned with instructional objectives and Nevada science standards (McTighe & Ferrara, 1998).

These measured outcomes allow each school to be held accountable for each student's achievement as measured by state mandated tests (Adams & Kirst, 1999, p.463). Before being held accountable, professional development based on Nevada science standards is required. Professional development will
assist teachers to base their decisions on educational principles and the goals of Nevada science standards.

Principals' facilitation of Nevada science standards, coupled with professional development, will directly influence the teaching processes employed to promote pupil learning (Gersten, Carmine, & Greene, 1982; Harris, 1985). Principals will facilitate science standards implementation through classroom supervisory practices that promote teacher behaviors commensurate with the goals of Nevada science standards. Principal's instructional leadership has been described as the link between effective teaching and student learning (Edmonds, 1982). Instruction, assessment, accountability, professional development, curriculum, and supervision are encompassed by instructional leadership behaviors. Instructional leadership links these categories together at a school. Keefe and Jenkins (1984) described instructional leadership as "the principal's role in providing direction, resources, and support to teachers and students for improvement of teaching and learning in the school (p.7). Broadly, instructional leadership is concerned with instruction, assessment, accountability, professional development, curriculum, and supervision (Blase & Blase, 1999A; Bossert, Dwyer, Rowan, & Lee, 1982; Gantor, Daresh, Dunlap, & Newsome, 1999; Glickman, 1985; Pajak, 1989).

Population

The population for this study was all Nevada public high school (grades 9–12) science teachers and principals. These participants were both men and
women who are currently employed in a Nevada public school. Using the Nevada State Department of Education (Nevada Department of Education, 2000), the population consisted of 425 science teachers and 130 principals, representing 65 public secondary high schools. These high schools were located in rural, suburban, and urban areas of the state.

Design of the Study

This study, utilized both quantitative and qualitative methods, described secondary principals' and science teachers' (grades 9 -12) perceptions of Nevada science standards impact on instruction, curriculum, assessment, accountability, professional development, supervision, and instructional leadership. In addition, the study determined if perceptions about these categories differed among science teachers and principals at small, medium, and large schools.

Quantitative methodology was employed to gain an understanding of science teachers' and principals' perceptions through the utilization of a questionnaire. Qualitative methodology was utilized to gain knowledge from a selected group of principals and teachers. This study was conducted within a single, dominant paradigm with one small component from the alternative paradigm. Creswell (1994) described this approach as a dominant-less dominant design (p.177). Creswell (1994) further proposed that "A classic example of this approach is a quantitative study based on testing a theory in an experiment with a small qualitative interview component in the data collection phase" (p.177).
The advantage to this approach was that it presented a consistent paradigm picture in the study and gathered limited information that examined in detail one aspect of the study (Creswell, 1994). In addition, the seven demographic variables collected were used descriptively to assist in discerning existing patterns. This demographic information added to the study's qualitative component by providing a robust picture of the population under investigation.

The study's quantitative component used a researcher developed questionnaire that employed a Likert-type scale to obtain science teachers' and principals' perceptions of the impact of Nevada science standards on the classroom. Cohen and Manion (1989) and Crowl (1996) acknowledged that surveys are used extensively in educational research to collect information that is not directly observable. Through this method, one can learn about the opinions, activities, and future endeavors of respondents (Johnson, 1977). Crowl (1996) further asserted that surveys are used when the population under consideration is relatively large or dispersed over a large geographical area. Thus, due to the geographical distribution and relatively large size of the population under study, a questionnaire was deemed most appropriate. In addition, questionnaires secure data at a minimum of time and expense (Miller, 1991).

A semi-structured telephone interview, based on responses from the mailed questionnaire was administered. Merriam (1998) suggested that all forms of qualitative research collect data through interviews. The main purpose of an interview is to obtain information when behaviors and feelings cannot be observed (p.72). Merriam (1998) also added that interviewing is necessary to
describe past events that are no longer possible to replicate. Interviewing can be used to collect data from a large number of people representing a broad range of ideas (Merriam, 1998; Miller, 1991). This study employed an interview with possible follow up questions that were created from the identified categories of instructional leadership: instruction, assessment, curriculum, accountability, and supervision.

Procedure for Collecting Data

Approval and permission was obtained by the University of Nevada, Las Vegas, and Clark County School District to conduct research with human subjects. A copy of this letter will be on file at the University of Nevada, Las Vegas and Clark County School District, Las Vegas, Nevada.

The Nevada science standards questionnaire, a researcher developed instrument, was used to measure Nevada’s secondary (9-12) principals’ and science teachers’ perceptions regarding Nevada science standards. On this questionnaire, item response ranged from disagree (1) to agree (5). Principals and science teachers were instructed to choose the number (1-5) that most accurately described their perceptions for each item at that time. A panel of experts established the face and content validity of the questionnaire. This panel of experts included Dr. Sally Zepeda, University of Georgia, Dr. George Pawlas, University of Central Florida, and Dr. Jeffrey Glanz, Keans University, New Jersey. Their suggestions were used to adjust and to modify the questionnaire.
Gall, Borg, and Gall (1996) and Miller (1991) suggested a thorough piloting of a questionnaire before using it in a study. The pilot should include a sample of the individuals from the population from which the study will draw its sample (p. 298). Creswell (1994) and Hopkins (1980) asserted that piloting a questionnaire is also useful to establish face validity and to improve questions, format, and scales. Hopkins (1980) further added that a pilot study should be used to check on how well design procedures are articulated and to identify any areas where logic and mechanical detail need additional attention (p. 182). The Nevada Science Standard Questionnaire was piloted at Green Valley High School. Green Valley High School is a comprehensive public secondary school (grades 9-12) located in Henderson, Nevada. The piloting was done using the following steps: (a) informally contacting principal explaining purpose of study, and (b) mailing a packet including cover letter with instructions and twenty-five questionnaires. Each questionnaire included an extra sheet where respondents can place comments aimed to improve ease of administration, format, scaling, and eliminate vague questions (Cohen & Manion, 1989; Creswell, 1994; Miller, 1991).

Piloting the questionnaire improved the response rate (Galfo, 1983; Gall, Borg, & Gall, 1996). Gall, Borg, and Gall (1996) stated that questionnaires mailed to educators generally expect to yield a higher percentage of replies than the general population. This is due to the target being a homogenous group and the specific appeal for participation is more effective. Gall, Borg, and Gall (1996) suggest a return rate of 66% or more from the pilot group or significant changes
are required before performing the questionnaire on population. The pilot questionnaire obtained a 95% (17/18) return rate.

The telephone interview was piloted using the administration and science faculty at Green Valley High School who indicated a willingness to be interviewed. Henerson, Morris, and Fitz-Gibbon (1987) contended that interviews provide valuable data, but are susceptible to bias. Therefore, the interview was piloted to ensure unbiased data was obtained. During the pilot interviews, the researcher was alert to communication problems and evidence for the need to rephrase or rewrite questions. Also, possibly threatening questions were eliminated or rewritten (Gall, Borg, & Gall, 1996). Gall, Borg, and Gall (1996) added that several methods of opening interview should be used to determine which one establishes greater rapport and cooperation. The pilot interview was tape-recorded that allowed the researcher to gain insight into the questioning process and to become aware of problems that went unnoticed during interview.

The semi-structured telephone interview involved a series of structured questions and then probing more deeply using open-ended questions to obtain additional information (Borg, Gall, & Gall, 1996; McMillan & Schumacher, 1984). Merriam (1998) stated that probes are questions that follow up something already asked. Although a list of possible probing questions was developed, it was virtually impossible to specify these ahead of time because they are dependent on how the respondent answers the lead question (Merriam, 1998,
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p.80). Merriam (1998) further implied that probing can come in the form of asking for more details, for clarification, or for examples.

Once the sample population, questionnaire, and semi-structured telephone protocol was finalized, a three-stage process was used for mailing the questionnaire as recommended by Creswell (1994) and Gall, Borg, and Gall (1996). This process included the following steps: (a) mailing an introductory letter introducing the researcher and the research study to each school's principal; (b) an initial mailing of the complete questionnaire with a cover letter; (c) telephone calls were made to each non-responding principal along with another complete mailing of the questionnaire.

Each complete mailing included a stamped, addressed return envelope, cover letter, and twenty questionnaires with envelopes. Two questionnaires were for the principal and the administrator (assistant principal or dean) who directly supervises science teachers. The remaining eighteen questionnaires were disseminated to the science teachers by the principal. Principals and teachers participating in the mailed questionnaire were asked if they would be willing to participate in a random telephone interview. From the list of agreeing teachers and principals, a random sample of three teachers and three principals were selected, representing small, medium, and large schools. Each telephone interview was recorded and transcribed to preserve the obtained data. The interview process proceeded over a three-week period.
Analysis of the Data

The results obtained from the mailed questionnaire were analyzed using descriptive statistics. Gall, Borg, and Gall (1996) stated that research in its most basic form involves the description of natural or manufactured phenomena (p.374). These authors stated that descriptive research is the basis for many future discoveries. Descriptive research is a type of quantitative research that involves making careful descriptions of educational phenomena. To describe the sample as a whole, a researcher will define variables, measure them, and for each measure compute descriptive statistics.

Descriptive statistics are measures of central tendency such as mean, median, mode, and measures of variability such as standard deviation, variance, and range (Gall, Borg, & Gall, 1996; Johnson, 1977; McMillan & Schumacher, 1984). Descriptive research often involves reporting the characteristics of one sample at one point in time. The values of mean, median, mode, and standard deviation were made from each questionnaire item. A frequency distribution was made for each questionnaire item showing how frequently each variable occurred among measured observations. From the frequency distributions, percentages were computed and displayed, that indicate the number of respondents who marked a particular category in relationship to the total number of respondents (Orlich, 1974).

According to Orlich (1974), the reporting of percentages and means are adequate analytical methods, with the use of computed means from Likert-type responses being most useful to researchers (p.144). The same Likert scale for
each questionnaire item allowed for the computation of means for each questionnaire item. Means easily illustrated agreements and disagreements among respondents.

Collected data from the Nevada science standard questionnaire was coded and entered into the statistical program, SPSS. Each respondent was assigned an identification code to protect privacy and to identify the respondent easily (Galfo, 1983; Gall, Borg, & Gall, 1996). Item responses were coded according to each subject's circled responses (Likert scale 1-5) for each questionnaire item. Once the data from the mailed questionnaire was coded and entered into the program, descriptive statistics (frequency, distribution, percentages, mean, median, mode, and standard deviation) were computed, describing the population's responses (Gall, Borg, & Gall, 1996).

Continuous data checks were done to ensure accuracy of data entry and data analysis. Data displays were visibly inspected for input errors. After waiting a period of time, the analysis results were checked, recalculated, and re-examined (Fink & Kosecoff, 1998; Gall, Borg, & Gall, 1996). Also, every attempt was made to remain objective and unbiased by including frequent review of the study's methods by other researchers and checking for omissions or unconscious biases (McMillan & Schumacher, 1984).

Telephone Interview

Each principal and teacher telephone interview was taped and transcribed to preserve the obtained data (Merriam, 1998). These interviews were analyzed
to determine themes, factors, and characteristics showing Nevada science standards impact on instruction, assessment, professional development, curriculum, supervision, and instructional leadership (Merriam, 1998; Spradley, 1980).

The semi-structured telephone interview involved a series of structured questions that were followed by probing, open-ended questions to obtain additional information (appendix IV) (Gall, Borg, & Gall, 1996; McMillan & Schumacher, 1984). Merriam (1998) stated that probes are questions that follow up something already asked. Although a list of possible probing questions was already developed, it was virtually impossible to specify these ahead of time because probing questions were dependent on how the respondent answered the lead question (Merriam, 1998, p.80). Those questions that provided ambiguous results or showed statistical significance were used to guide the interview process. This allowed the researcher to focus on areas of strengths and weaknesses in relation to the questionnaire (Gall, Borg, & Gall, 1996). Borg and Gall (1989) contended that “the interview permits you to follow-up leads and thus obtain more data and greater clarity… (providing) much greater depth than the other methods of collecting research data” (p.289). Merriam (1998) further implied that probing can come in the form of asking for more details, for clarification, or for examples.

The telephone interviews of principals and science teachers were taped and transcribed to preserve the obtained data (Merriam, 1998). Interview data was analyzed by establishing themes, factors, and characteristics common to
responses. These domains assisted in determining Nevada science standard's impact on instruction, assessment, professional development, curriculum, supervision, and instructional leadership (Merriam, 1998; Spradley, 1980).

Each interview tape was clearly labeled and an interviewer's journal was kept to document interviews and all contacts with respondents. Names were not used, but letters were assigned to ensure privacy (Gall, Borg, & Gall, 1996). Creswell (1994) suggested that data collection involves a) setting boundaries for study, b) collecting data by interviews, and c) establishing interview protocol (p.148). Data organizing was done as Creswell (1994) described as an advance protocol for data entry. This protocol was prepared in advance to record all data for analysis. Interviews were quickly transcribed after the interview's completion (Gall, Borg, & Gall, 1996; Johnson 1977).

Data analysis consisted of emergent categories, themes, or patterns collected from interview process. Domains were developed that were internally consistent with the study's constructs but distinct from one another (Creswell, 1994; Spradley, 1980). Creswell (1994) explained flexible rules given as to how to sort raw data, but domains would emerge. In this case, however, the categories were predetermined: instruction, assessment, professional development, accountability, curriculum, supervision, and instructional leadership.
Significance of the Study

Fletcher (1998) maintained that standards-based reform differs from past reforms due to its emphasis on systemic change. However, Fletcher posed a significant question: "Will change follow in the science classroom?" (p.2). To be successfully implemented in Nevada, standards–based reform efforts require both science teachers and principals to be engaged in the process. Cross and Joftus (1997) implied that for science teachers, standards-based reform requires content knowledge, appropriate evaluation of all students, and focus on instructional improvement. The link between these teaching requirements and student learning is instructional leadership (Martin, 1990).

Blase and Blase (1999a) noted there have been few descriptive studies of instructional leaders and their impact on teachers and classroom instruction. This study examined instructional leadership behaviors in the implementation of Nevada science standards. By describing effective instructional leadership behaviors, this study contributed to the existing literature, scholarship, and dialogue. In addition, this study was significant for Nevada educational policy.

Implementation of Nevada science standards represents an investment of resources from the state government. However, the success of these standards resides in science teachers and principals. It was germane to describe, then, the perceptions that these individuals possess regarding Nevada science standards' impact on science instruction, assessment, curriculum, accountability, professional development, supervision, and instructional leadership. If principals' and science teachers' perceptions revealed standards are not impacting science
curricula and classroom instruction as intended, the Nevada State legislature may wish to re-examine methods by which it imposes such standards. State resources can then be used to find alternative reform strategies, methods, and policies. If these standards are positively affecting Nevada’s science classrooms, this study described areas affected, providing information to direct future standards-based reform efforts.

The impact of Nevada Science standards on small, medium, and large schools will also be examined. Stockard and Maybery (1986), who examined the influence of instructional leadership affecting student achievement in small-scale and large-scale schools, suggested that instructional leadership works in different ways at different school settings. Friedkin and Necochea (1988) described that good school climate and instructional leadership would be easier to achieve in small-scale schooling rather than large-scale schooling. Howley (1996) suggested that small-schools could have a positive influence on student achievement. However, policy-makers believe that large schools are more cost-effective and more educationally efficient (Howley, 1996). Many Nevada secondary schools have a student enrollment of over 2,000 students. If standards are important and student achievement is the goal of Nevada science standards, policies may be examined to reduce the large student populations at schools are over 2,000 to promote greater student achievement and good leadership.
Limitations

Borg and Gall (1989) stated that the “weaknesses in educational research can be attributed to the inadequacies of our measures” (p. 183). Miller (1991) reported that the following limitations associated with mailed survey techniques. These include:

1. Response rates to most questionnaires do not generally exceed 50% when conducted by private and relatively unskilled person; intensive follow-up efforts are required;

2. Those who answer the questionnaires may differ slightly from non-respondents, thereby biasing the sample; and,

3. Non-respondents become a collection of individuals about whom virtually nothing is known (p. 141).

Issac and Michael (1989) further stated the limitations of survey methodology. These included:

1. Questionnaires only tap respondents who are accessible and cooperative;

2. Questionnaires often make the respondents feel special or unnatural thereby producing responses that are artificial;

3. Questionnaires arouse “response sets” that are prone to agree with positive statements or questions; and,

4. Questionnaires are vulnerable to over-rater or under-rater bias, causing some respondents to give consistently high or low ratings (p. 128.)

The interview also has limitations as a research tool (Borg & Gall, 1989). Henerson, Morris, Fitz-Gibbon (1987) implied that the oral responses given in
interviews are time-consuming. These authors also indicated that the interviewer might unduly influence the respondent. The respondent may become worried about why they are being questioned, what they are expected to say, and how their responses will be interpreted. (p.26).

Although the interview was arranged around respondent indicated schedule, Miller (1991) suggested that a phone-interview could catch an individual in another activity. These activities may distract the respondent or cause feelings directed toward the research such as frustration, anxiety, and hostility that may interfere with the interview.

The generalizability of this study is limited to principals and science teachers at the secondary level (grades 9-12) in Nevada.

The reliability of the educational measures is the "...the level of internal consistency or stability of the measuring devise over time" (Borg & Gall, p.257). The reliability of a survey questionnaire makes assumptions that differences in answers stem from differences among respondents rather than differences in stimuli to which respondents are subjected (Fowler, 1998). Thus, the wording of a questionnaire needs to be clearly understandable and unambiguous. A review of the questionnaire by field experts and a pilot test was used to develop a more reliable instrument.

The researcher is another added limitation to the study Gall, Borg, and Gall (1996) discussed that the researcher has an emotional stake in the outcome of the research that may make this individual susceptible to bias. These biases can be manifested in many different ways such as making errors in sampling,
selecting measures inappropriately, or scoring responses of the subject incorrectly. This researcher is a science teacher in Nevada who has been affected by Nevada science standards. Hence, every attempt was made to remain objective and unbiased by including frequent review of the study's methods by other researchers and checking for omissions or unconscious biases (Gall, Borg, & Gall, 1996; McMillan & Schumacher, 1984).

A dominant-less dominant design’s chief disadvantage is that qualitative purists would acknowledge this approach as misusing the qualitative paradigm because the study’s central assumptions would not link or match the qualitative data collection procedures. Conversely, quantitative purists would also be concerned about the match of paradigms (Creswell, 1994, p. 177). Gall, Borg, and Gall (1996) further added that limitations involve statistics. These authors indicated that the researcher misinterprets the meaning of an obtained p value, overstates the importance of small differences that are statistically significance, and performs statistical analysis before carefully examining the raw data.

Summary

National standard documents such as the National Science Education Standards (NRC, 1996) have benchmarked what the nation’s K – 12 student population should be able to do or know by the conclusion of certain grade levels. By an act of the Nevada State Legislature in 1997, high academic standards were mandated in Nevada (Nevada Department of Education, 2000). Ultimately, these standards will be measured by state sponsored standardized
tests. Thus, as well as demanding higher student achievement in Nevada, teachers and administrators will be held accountable for meeting these standards.

Nevada science standards define the curriculum revision needed to occur for Nevada students to achieve a high level in science education, but according to Fletcher (1998) the obvious question should be asked, "will significant changes follow in science classrooms?" (p. 2). An important step in addressing this question is to assess the perceptions that administrators and science teachers hold about science standards as well as the possibilities of implementation. After addressing this question, policy makers may be able to determine the most effective course of action to achieve implementation (Fletcher, 1998).
CHAPTER FOUR

ANALYSIS AND INTERPRETATION OF THE DATA

Introduction

Education in the United States has undergone cyclic reform cycles (Adams & Murphy, 1998). The current reform cycle has been dubbed the "excellence era" that had its beginning in policies intended to enhance student learning (Adams & Murphy, 1998, p.426). According to Marzano and Kendall (1997), the publication of A Nation at Risk (National Commission on Excellence in Education, 1983) was the initiating event for this current reform cycle and ushered in the modern standards movement.

The standards movement has linked the financial security and the economic competitiveness of the nation to its educational system (Marzano & Kelly, 1997). Sykes (1999) noted that the importance of standards comes from a cross-national comparison. Studies have portrayed high-achieving nations such as Germany and Japan as possessing a common set of standards that defines the curriculum, knowledge, and skills students are to master (Eckstein & Noah, 1993; Raizen, 1998; Stevenson & Stigler, 1992). In response to growing concerns about education, a national education summit was held in 1989. Marzano and Kendall (1997) suggested that the tacit purpose of this summit was to motivate educators to set challenging standards in all major academic areas.
Responding to the education summit's urge for standards, several professional organizations developed science education standards (Raizen, 1998). The American Association of the Advancement of Sciences (AAAS) and the National Science Teachers Association developed a set of national standard documents. These documents identified major scientific concepts and themes that students (grades 9 – 12) should have achieved by the time a specific grade level has been completed. Nerison-Lowill and Ashwill (1999) showed that currently all 50 states have adopted academic standards. These standards are based on national standards to serve as a framework for their state standards (Cross & Joftus, 1997).

The Nevada state legislature, in 1998, enacted the Nevada Education Reform Act (NERA) to create standards to improve and to ensure high academic achievement among Nevada's students (Nevada Department of Education, 2000). In addition, this legislation aimed to influence instruction, assessment, accountability, professional development, and curriculum and practices in Nevada. The passage of this legislation facilitated the development of Nevada science standards that would impact the science curriculum.

However, in order for standards-driven reform to be successful, it will require a change in how principals and science teachers work together (Anderson, 1996). Principals, acting as instructional leaders, will be crucial if standards implementation is successful. Many researchers argued that instructional leadership is the primary vehicle for facilitating school learning and
promoting new, innovative school practices such as Nevada science standards (Boyd, 1990; Edmonds, 1982; Harris, 1998; Martin, 1990).

To ascertain the impact on Nevada science standards on Nevada's science classrooms, the following research questions will be answered:

1. How do principals and science teachers differ regarding their perceptions of the impact of Nevada science standards on
   a. instruction,
   b. assessment,
   c. accountability,
   d. professional development,
   e. curriculum, and
   f. supervision.

2. What are principals doing to implement Nevada science standards?

3. Are there differences in perceptions among science teachers and principals at small, medium, and large schools?

The purpose of this study was to describe and to examine secondary principals' and secondary science teachers' perceptions of how Nevada science standards influenced instruction, curriculum, assessment, accountability, professional development, supervision, and instructional leadership. Furthermore, this study compared principals' and secondary science teachers' perceptions of how Nevada science standards influence instruction, curriculum,
assessment, accountability, professional development, supervision, and instructional leadership at small, medium, and large schools in Nevada.

Methodology

A questionnaire was developed (see Appendix I and II) as a method of answering the research questions that guided the study. The questionnaire consisted of seven demographic variables and forty-nine questionnaire items related to one of seven characteristics: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, (f) supervision, and (g) instructional leadership.

In addition to the mailed questionnaire, a semi-structured telephone interview was constructed as a secondary means of collecting science teachers' and administrators' perceptions about the impact of Nevada science standards. An interview protocol (see Appendix IV) was developed around each characteristic to investigate further the research questions. Telephone interviews averaged 45 minutes in length. The data obtained from the mailed questionnaire and the semi-structured telephone interviews were used to triangulate the collected data. According to Creswell (1994), triangulated measures provide results that are more reliable. Thus, the use of a questionnaire and telephone interviews resulted in more robust findings of how Nevada science teachers and administrators perceive the impact of science standards.
Population

The population for this study was all Nevada public high school (grades 9-12) science teachers and principals. These participants were both men and women who are currently employed in a Nevada public school. The population consisted of 425 science teachers and 130 principals, representing 65 public secondary high schools. These high schools were located in rural, suburban, and urban areas of the state.

Questionnaire

A questionnaire packet was mailed to all sixty-five Nevada public high schools, grades 9-12. Of these sixty-five, two high schools were grades 7-12. These two high schools were rural schools that served a large geographical region with a small population. To ensure accurate representation of all Nevada high schools, these two schools were included within the population studied. All 65 Nevada high schools were mailed a questionnaire packet that included an introduction letter, administrator questionnaires, science teacher questionnaires, and stamped, addressed return envelopes. The first mailing resulted in 27 school packets returned, for an initial return rate of 42%. Two schools returned their questionnaire packet indicating that they did not wish to participate in the study.

After two weeks, follow-up telephone calls were made to each non-responding school. Direct contact was made with all the non-responding schools. This contact allowed the researcher to explain verbally the purpose of
the study as well as to answer questions. After the follow-up contact was made, a second mailing was sent to each non-responding school. An additional 16 questionnaire packets returned after the second mailing. This resulted in 43 schools responding establishing a school return rate of 66%. One hundred and ninety-five science teachers responded providing a return rate of 46% (195/425) and 56 administrators responded providing a return rate of 43% (56/130).

Item responses for each question item ranged from disagree (1) to agree (5). The questionnaire instructed respondents to choose the number (1 – 5) that most appropriately described their own perceptions in relation to each questionnaire item. The questionnaire took approximately 10 minutes for each respondent to complete.

Science Teacher and Administrator Interview

Science teacher and administrator interviews were conducted during a three week period following the return of the first questionnaire packet. Twenty three percent (44/195) of science teachers and 43% (24/56) of administrators indicated that they would volunteer for a telephone interview. One science teacher and one administrator from a small, medium, and large school were interviewed randomly.

School size was determined by student enrollment as indicated by questionnaire responses and displayed in Table 1. Small schools were defined as schools with a student enrollment of 900 or less, medium schools were defined as schools with a student enrollment between 901 – 1999, and large
schools were defined as schools with a student enrollment of 2000 or greater. In this study, the population of schools consisted of 20 small schools, 14 medium schools, and 13 large schools. The majority of science teachers, 44% (85/195), indicated being employed at a large school whereas the majority of administrators indicated working at a small school. However, this was expected since large schools tend to employ more science teachers.

Table 1

Number of Science Teachers and Administrators in Small, Medium, and Large Schools

<table>
<thead>
<tr>
<th>School Size</th>
<th>Enrollment</th>
<th># of schools</th>
<th>Teachers (as % of respondents)</th>
<th>Administrators (as % of respondents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>900 or Less</td>
<td>20</td>
<td>22% (43/195)</td>
<td>41% (23/56)</td>
</tr>
<tr>
<td>Medium</td>
<td>901 - 1999</td>
<td>14</td>
<td>34% (66/195)</td>
<td>30% (17/56)</td>
</tr>
<tr>
<td>Large</td>
<td>2000 or Greater</td>
<td>13</td>
<td>44% (86/195)</td>
<td>29% (16/53)</td>
</tr>
</tbody>
</table>

Six random interviews were conducted. A forced selection was done with the large school administrator due to only one school administrator volunteering to be interviewed. The 85 large school science teachers represented 44% (86/195) of the science teacher population, but only 9 large school science teachers volunteered to be interviewed in this study. This contrasted with small
and medium sized schools where 30% (13/43) of small school science teachers volunteered to be interviewed and 33% (22/66) of medium school science teachers volunteered to be interviewed.

Once science teachers and administrators were chosen, telephone calls were made. On the questionnaire, each respondent provided a number and a time most conducive for calling. A semi-structured interview was used that consisted of seven questions that revolved around the seven measured characteristics: instruction, assessment, accountability, professional development, curriculum, supervision, and instructional leadership (see Appendix I). Each interview lasted between 45-50 minutes and was taped recorded and transcribed.

The following section presents the results of both mailed questionnaire and telephone interview data. The questionnaire results will be presented with telephone interview results to support the questionnaire data.

Description of Science Teachers and Administrators

Respondents were asked seven demographic questions on the questionnaire to understand better the population under study. The responding science teachers and administrators provided information about the following: (a) gender, (b) level of education, (c) number of college science courses completed, (d) school's enrollment, (e) teaching experience, and (f) administrative experience. Demographic information was collected as a qualitative component of the study to illustrate further the examined population.
From the 195 science teachers responding, 59% (115/195) were males and 41% (79/195) were females. The 56 administrators participating in the study consisted of 61% (34/56) males and 39% (22/56) females. Fifty-four percent (106/195) of science teachers held a bachelor's degree and 46% (89/195) indicated having earned a master's degree. A Nevada administrative endorsement does require a master's degree, which was reflected by all responding administrators possessing a master's degree. In addition, respondents provided the total number of years of experience in both teaching and administration. Nevada science teachers reported a mean teaching experience of 11.2 years; administrators reported a mean teaching experience of 16.2 years and a mean administrative experience of 10.4 years. Of the responding 56 administrators, 32 were principals, 18 were assistant principals, and 6 were deans.

Table 2 displays teacher experience compared to school size. Sixty-eight percent of the population indicated 15 or fewer years of teaching experience. Of these individuals, 53% had between 1 and 5 years teaching experience, and the majority of these individuals, 35 (51%), were employed at large schools. At large schools, 78% of the individuals had 15 or fewer years of experience. However, small and medium sized schools also indicated a large number of individuals with 15 or fewer years of teaching experience. In small schools, 76% of the individuals possessed 15 years or fewer years of experience, whereas medium schools indicated 65% possessing 15 years or fewer years of teaching experience.
Table 2

**Teaching Experience at Small, Medium, and Large schools**

<table>
<thead>
<tr>
<th>Experience in Years</th>
<th>Small Schools (&lt;900 students)</th>
<th>Medium Schools (901-1999 students)</th>
<th>Large Schools (&gt;2000 students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5</td>
<td>13</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>6 – 10</td>
<td>17</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>11 – 15</td>
<td>20</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td>16 – 20</td>
<td>4</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>21 – 25</td>
<td>5</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>26 – 30</td>
<td>4</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>31+</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>83</td>
<td>95</td>
</tr>
</tbody>
</table>

Table 3 displays administrative experience compared to school size. The majority of administrators responding indicated possessing 10 or fewer years of experience as a school administrator. Eleven individuals had 16 years or more years of experience. Small and medium sized schools had a greater percentage of administrators with over five years administrative experience.
Table 3

Administrative Experience at Small, Medium, and Large schools

<table>
<thead>
<tr>
<th>Experience in Years</th>
<th>Small Schools (&lt;900 students)</th>
<th>Medium Schools (901-1999 students)</th>
<th>Large Schools (&gt;2000 students)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 5</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>6 - 10</td>
<td>9</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>11 - 15</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>16 - 20</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>17</td>
<td>13</td>
</tr>
</tbody>
</table>

* missing data

Science teachers and administrators were asked to reveal the number of college science courses taken as displayed by Table 4. The majority of science teachers, 81% (158/195), indicated completing 13 or more science classes. These 13 classes translate into approximately 39 or more credit hours, representing a college major. Eighteen percent (15/195) of responding science teachers revealed taking fewer courses than would be required for a college major. Sixty-eight percent (38/56) of administrators denoted six or less completed science courses.
Table 4

Number of College Science Courses Completed

<table>
<thead>
<tr>
<th>Number of Science Courses Completed</th>
<th>Teachers (N=193*)</th>
<th>Administrators (N=56)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 3</td>
<td>2%</td>
<td>34%</td>
</tr>
<tr>
<td>4 - 6</td>
<td>2%</td>
<td>34%</td>
</tr>
<tr>
<td>7 - 9</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>10 - 12</td>
<td>10%</td>
<td>5%</td>
</tr>
<tr>
<td>13+</td>
<td>81%</td>
<td>25%</td>
</tr>
</tbody>
</table>

*missing data

Research Questions

Research Question One

Research question one asked how principals and science teachers differ regarding their perceptions of the impact of Nevada science standards on (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, and (f) supervision. The responses are displayed as frequencies and for each questionnaire item, a t-test was completed (p<.05) comparing administrator and science teacher responses. Items that were significant were noted and t-test results are found in appendix VI.
Instruction

Five questionnaire items were related to the perception of science teachers and administrators regarding the impact of Nevada science standards on classroom instruction. Table 5 displays these results. All items showed a significant statistical difference between science teachers and administrators except the items that asked if Nevada science standards guide lesson plan development (item 25).

Seventy-three percent or more of administrators responded favorably (agreed or somewhat agreed) to five of the questionnaire items related to instruction. These referred to science standards (a) positively impacting the science curricula (item 22/75% & item 27/77%), (b) providing common expectations (item 33/95%), (c) guiding lesson plan development (item 25/91%), (d) allowing science teachers to emphasize teaching and learning (item 29/73%), and (e) providing common academic expectations for all students (item 33/95%). Sixty-eight percent or more of science teachers agreed or somewhat agreed that science standards guide lesson plan development and provide common expectations for all students. Science teacher B (medium school) implied that Nevada science standards provide common expectations for all students. All interviewed respondents indicated using or emphasized using the backward assessment model (BAM) to guide lesson plan development. The backward assessment is a curriculum method that links the curriculum to classroom instruction.
Table 5

Instruction Results Summary

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td>A %</td>
</tr>
<tr>
<td>#17* help teachers develop interdisciplinary (integrated) approaches to content areas.</td>
<td>11%</td>
</tr>
<tr>
<td>#22* have positively impacted science instruction.</td>
<td>12%</td>
</tr>
<tr>
<td>#25 guide lesson plan development.</td>
<td>31%</td>
</tr>
<tr>
<td>#27* have had a positive impact on science instruction.</td>
<td>13%</td>
</tr>
<tr>
<td>#29* allow science teachers to emphasize teaching and learning.</td>
<td>10%</td>
</tr>
<tr>
<td>#33* provide common academic expectations for all students.</td>
<td>28%</td>
</tr>
</tbody>
</table>

Administrators

<table>
<thead>
<tr>
<th>A %</th>
<th>SA %</th>
<th>N %</th>
<th>SD %</th>
<th>D %</th>
</tr>
</thead>
<tbody>
<tr>
<td>21%</td>
<td>41%</td>
<td>23%</td>
<td>9%</td>
<td>5%</td>
</tr>
<tr>
<td>25%</td>
<td>50%</td>
<td>20%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>27%</td>
<td>64%</td>
<td>7%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>26%</td>
<td>51%</td>
<td>24%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>27%</td>
<td>46%</td>
<td>23%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>45%</td>
<td>50%</td>
<td>2%</td>
<td>4%</td>
<td>0%</td>
</tr>
</tbody>
</table>

* p < .05

Table 5 points out the difference in perceptions between science teachers and administrators. Furthermore, science teachers disagreed with administrators' perceptions that Nevada science standards (a) have positively impacted the science curriculum (item 27), and (b) help develop interdisciplinary approaches to content areas (item 17). When asked about Nevada science standards' impact on instruction, science teacher A (small school) stated, "It has limited my personal freedom in teaching." However, Administrator A (small
school), responding to the same question suggested, “I would say it [Nevada science standards] has given science a little more direction.”

The questionnaire items that asked if Nevada science standards (a) guide lesson plan development (item 25), and (b) provide common academic expectations (item 33) demonstrated the highest degree of agreement between science teachers and administrators. In particular, administrators and science teachers shared the perception that Nevada science standards guide lesson plan development (item 25); seventy-five percent of science teachers and 81% of administrators believed Nevada science standards guide lesson plan development. Supporting this perception, science teacher B stated that, “I think I copy the backward assessment model more,” and administrator C added, “Our science department gets together to establish their benchmarks based on the standards and every teacher...knows what it is they should be doing...”

In addition, 68% of science teachers and 95% of administrators perceived that Nevada science standards provide common expectations for all students in Nevada’s classrooms (item 33). Regarding their perception of Nevada science standards helping teachers develop interdisciplinary (integrated) approaches to content, item 17, 37% of science teachers responded positively, either agreed or somewhat agreed, as opposed to 63% of administrators responding positively to that statement. Science teachers’ and administrators’ perceptions differ on whether Nevada science standards have had a positive impact on science instruction (item 27). Thirty-six percent of science teachers agreed or somewhat
agreed responded to this statement; conversely, 76% of administrators agreed or somewhat agreed.

Assessment

Four questionnaire items were related to the perception of science teachers and administrators regarding the impact of Nevada science standards on assessment. Table 6 reflects these results. All four questionnaire items showed a significant difference between science teacher and administrator perceptions. Seventy-five percent of administrators agreed or somewhat agreed that Nevada science standards are used to design student assessment programs in science classrooms while only 55% of science teachers agreed or somewhat agreed with that statement. Administrator B (medium school) implied that classroom assessment practices have changed because "they [science teachers] may be structuring their questions a little differently on their teacher made tests so they're a little closer in line with what would be on a state standardized test." Science teacher C (large school) stated, "They [students] still get standard testing."

Eighty-two percent of administrators agreed that Nevada science standards would help improve academic achievement of students whereas only 42% of science teachers agreed with that statement (item 16).

Reporting their perception that Nevada science standards assist students in learning science (item 32), 80% of administrators responded favorably; in comparison, only 40% of science agreed or somewhat agreed with this.
### Table 6

**Assessment Results Summary**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td>A SA N SD D</td>
<td>A SA N SD D</td>
</tr>
<tr>
<td># 10* are used to design student assessment programs.</td>
<td>16% 40% 24% 16% 5%</td>
<td>27% 50% 15% 6% 2%</td>
</tr>
<tr>
<td># 16* help improve academic achievement of students.</td>
<td>11% 31% 24% 20% 15%</td>
<td>35% 49% 15% 2% 0%</td>
</tr>
<tr>
<td>#32* assist students in learning science.</td>
<td>9% 31% 23% 23% 15%</td>
<td>16% 64% 13% 7% 0%</td>
</tr>
<tr>
<td>#34* reflect our expectations for student achievement.</td>
<td>19% 36% 20% 16% 8%</td>
<td>41% 43% 9% 5% 2%</td>
</tr>
</tbody>
</table>

*p < .05

In addition, respondents were asked if they believed Nevada science standards reflect their expectations for student achievement (item 34). Eighty-four percent of administrators of administrators admitted it did, but again, a smaller percentage of teachers did, only 55%. Administrator B (medium school) noted, "I think they (standards) give them a different basis for assessing students."

In the area of assessment, science teachers and administrators had the greatest difference in perceptions on standards' impact on improving the academic achievement of students (item 16 – administrators 84% / science teachers 42%) and assisting students in learning science (item 32 – administrators 80% / science teachers 40%). Science teacher A responded to
these items by saying, "What does bother me is when there are 280 objectives to be learned in one grade level. It's awful heavy. You know. We're teaching it. That's it."

Accountability

Research question one asked how do principals and science teachers differ regarding their perceptions of the impact of science standards on accountability. All questionnaire items showed significant differences between science teachers and administrators. Table 7 illustrates science teacher and administrator responses to these items. The Nevada science standard questionnaire asked if science standards (a) assist administrators in holding parents accountable for student learning (item 7), and (b) assist teachers in holding parents accountable for student learning (item 8). Within the accountability category, these two items had the lowest frequency of favorable responses (either agree or somewhat agree) from administrators and science teachers as well as closest agreement between the two groups. Seventeen percent of science teachers and 27% of administrators agreed or somewhat agreed with item 7, and 18% of science teachers and 31% of administrators agreed of somewhat agreed with item 8. Referring to parental accountability, questionnaire item 7 was the only item in the accountability category not to show a significant difference between science teachers and administrators. Science
Table 7

Accountability Results Summary

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td></td>
<td></td>
</tr>
<tr>
<td># 2* assist in holding students accountable for developing certain knowledge and skills.</td>
<td>25%</td>
<td>34%</td>
</tr>
<tr>
<td># 3* assist administrators in holding teachers accountable for student learning.</td>
<td>22%</td>
<td>24%</td>
</tr>
<tr>
<td>#4* assist administrators in holding teachers accountable for instructional improvement.</td>
<td>19%</td>
<td>26%</td>
</tr>
<tr>
<td>#5* assist teachers in holding administrators accountable for student learning.</td>
<td>11%</td>
<td>15%</td>
</tr>
<tr>
<td>#6* assist teachers in holding administrators accountable for instructional improvement.</td>
<td>11%</td>
<td>16%</td>
</tr>
<tr>
<td>#7 assist administrators in holding parents accountable for student learning.</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>#8* assist teachers in holding parents accountable for student learning.</td>
<td>5%</td>
<td>13%</td>
</tr>
<tr>
<td>#9* assist students in holding themselves accountable for student learning.</td>
<td>12%</td>
<td>25%</td>
</tr>
</tbody>
</table>

*p<.05
teacher A (small school) stated that "Nevada science standards will not change anything about parent accountability issues."

Within the accountability category, questionnaire items that referred to science standards' impact on (a) assisting administrators in holding teachers accountable for student learning (item 3), (b) administrators holding teachers accountable for instructional improvement (item 4), and (c) assisting students in holding themselves accountable for their own learning (item 9) showed the greatest difference in perceptions between administrators and science teachers. In response to science standards' assisting administrators in holding teachers accountable for student learning, administrator A (small school) said, "It is more measurable [accountability] because you can say this is what we taught, this is how we tested, and this is where the kids are." In contrast, science teacher B (medium school) added, "I think if we start making teachers more accountable based on their grades, I think you will see a lot more grade inflation. My opinion is that we're doing everything possible to get kids to pass except [emphasis added] make them more accountable." Conversely, administrator C suggested, "We try to hold kids accountable for learning. I think we always have you know there is some resistance to that philosophy, but I think through education history, we try to hold kids accountable for their learning." Science teacher B (small school) also added that standards do not affect student accountability at school because "they (students) just ignore it [proficiency exams] or do not mind it [proficiency exams]."
Professional Development

Five questionnaire items were related to the perception of science teachers and administrators regarding the impact of Nevada science standards on professional development. Table 8 displays these results. All items showed a significant statistical difference between science teachers and administrators. The largest difference between science teachers and administrators perceptions in this category referred to Nevada science standards' impact on promoting group development among science teachers (item 31). Forty-three percent of science teachers responded favorably (agree or somewhat agree) while 86% of administrators responded favorably to this item. In response to this item administrator B (medium school) stated, "[What is good about Nevada science standards]...is just the collaboration between teachers working together. They're really getting together, discussing all their units, their plans..." Item 21, regarding standards impact on promoting professional dialogue among science teachers, produced a large discrepancy between administrators and science teachers where 47% of science teachers and 79% of administrators responded favorably. Administrator B (medium school) suggested "It's [Nevada science standards] made a lot of dialogue between teachers." Administrator B added, "High schools are so compartmentalized. It is great spending time dialoguing with colleagues and getting together." In addition, item 13 demonstrated the closest agreement between science teachers and administrators perceptions regarding science standards impact on professional development programs. This item elicited a favorable response from 51% of science teachers and 78% of administrators.
Table 8

Professional Development Results Summary

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td>A SA N SD D</td>
<td>A SA N SD D</td>
</tr>
<tr>
<td>#13* are used to design science professional development programs.</td>
<td>16% 36% 23% 11% 14%</td>
<td>36% 42% 15% 6% 2%</td>
</tr>
<tr>
<td>#18 are understood by science teachers.</td>
<td>28% 31% 21% 15% 5%</td>
<td>29% 45% 11% 13% 4%</td>
</tr>
<tr>
<td>#19* are understood by administrators.</td>
<td>12% 25% 25% 23% 16%</td>
<td>27% 45% 7% 16% 5%</td>
</tr>
<tr>
<td>#21* encourage science teachers to promote professional dialogue among them.</td>
<td>14% 32% 18% 22% 14%</td>
<td>25% 54% 18% 18% 4%</td>
</tr>
<tr>
<td>#31* promote group development among science teachers.</td>
<td>15% 28% 30% 16% 11%</td>
<td>20% 56% 16% 7% 0%</td>
</tr>
</tbody>
</table>

*p<.05

Curriculum

Seven items focused on science teachers' and principals' perceptions regarding the impact of Nevada science standards on curriculum. Table 9 illustrates these responses. All questionnaire items demonstrated a significant difference. Seventy-two percent of science teachers and 88% of administrators agreed or somewhat agreed with question item 13 that suggested standards provide a guide for curriculum development at their school.
### Table 9

**Curriculum Results Summary**

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td>A</td>
<td>SA</td>
</tr>
<tr>
<td>#1*  have established common expectations to guide curriculum development.</td>
<td>34%</td>
<td>39%</td>
</tr>
<tr>
<td>#14* match our goals for what we want and expect from science curricula.</td>
<td>16%</td>
<td>33%</td>
</tr>
<tr>
<td>#15* guide our goals for what we want and expect from science curricula.</td>
<td>21%</td>
<td>40%</td>
</tr>
<tr>
<td>#20* are a priority.</td>
<td>23%</td>
<td>36%</td>
</tr>
<tr>
<td>#23* have been implemented in to our science curricula.</td>
<td>42%</td>
<td>39%</td>
</tr>
<tr>
<td>#28* have improved the pre-existing curricula.</td>
<td>9%</td>
<td>35%</td>
</tr>
<tr>
<td>#30* are aligned with current science curricula</td>
<td>24%</td>
<td>38%</td>
</tr>
</tbody>
</table>

*p<.05

In addition, 15% of science teachers responded neutral to this question item.

Forty-nine percent of science teachers perceived that Nevada science standards match their goals for what they want and expect from science curriculum (item 14) whereas 78% of administrators responded favorably. However, a higher frequency of science teachers, 61%, agreed or somewhat agreed that science
standards guide what they want and expect from their science curriculum (item 15) and 81% of administrator responded positively (agreed or somewhat agreed) to this question.

When asked if science standards improved the pre-existing curricula, science teacher A (small school) responded, "It [Nevada science standards] definitely gave it direction." Administrator C (large school) proposed that "...they have [Nevada science standards] made our curriculum more consistent...across the board." Several schools indicated modifying their curriculum in response to Nevada science standards. Science teacher A (small school) said, "We've totally restructured our science program in that we're on block schedule." In assisting meeting the demands of science standards, science teacher C (large school) discussed adding a new class to address those demands, but negatively stated, "It's kind of upsetting because we have to go back and like next year is our first year of starting principles of science at our school. We're putting the very low stanines in there.

Supervision

Research question one measured science teachers and principals' perception of the impact of Nevada science standards on supervision. Table 10 illustrates administrators and science teachers' response frequencies to the supervision questionnaire items. Questionnaire items related to supervision asked if Nevada science standards (a) assist classroom supervision (item 11), (b) are discussed during evaluation conferences, (c) are used to supervise
Table 10

Supervision Results Summary

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td>At my school, I believe Nevada science standards... are used to assist teacher supervision in science classrooms.</td>
<td>% % % % %</td>
<td>% % % % %</td>
</tr>
<tr>
<td>#11*</td>
<td>7% 23% 25% 23% 22%</td>
<td>20% 40% 22% 11% 7%</td>
</tr>
<tr>
<td>#12* are discussed during teacher evaluation conferences.</td>
<td>14% 23% 15% 20% 29%</td>
<td>33% 35% 11% 11% 9%</td>
</tr>
<tr>
<td>#24* are used to supervise teacher performance.</td>
<td>11% 26% 29% 20% 14%</td>
<td>13% 47% 27% 7% 6%</td>
</tr>
<tr>
<td>#26* have had a positive impact on classroom supervision.</td>
<td>6% 16% 33% 21% 24%</td>
<td>15% 38% 36% 6% 6%</td>
</tr>
</tbody>
</table>

*p < .05

teacher performance (item 24), and (d) have had a positive impact on classroom supervision (item 26).

Each supervision questionnaire item revealed a significant difference between administrators and science teachers' perceptions. Less than 37% of teachers responded favorably (agreeing or somewhat agreeing) that science standards (a) assist classroom supervision (item 11), and (b) are discussed during evaluation conferences (item 12) whereas 60% or more of administrators responded positively to these items. In addition, 45% or more of responding science teachers either disagreed or somewhat disagreed with these items.
Science teacher C (large school) when asked if science standards are discussed during evaluation conferences responded, "No." Science teacher A (small school) added, "Two years ago on my evaluation in the needs to improve section the individual [administrator] had stated to make sure that 'you're covering state and district standards.' Well, the problem is...that is a great thing to say, fine. Have you [administrator] asked me? You [administrator] have not. Had you [administrator] looked in my lesson plan you [administrator] would have seen a copy of the curriculum that is based on standards and a check next to each state standard that were taught.

Research Question Two

Instructional Leadership

Research question two asked "What are principals doing to implement Nevada science standards?" This question illustrates the concept of instructional leadership that was defined as "the principal's role in providing direction, resources, and support to teachers and students for improvement of teaching and learning in the school" (Keefe & Jenkins, 1984, p.7). Table 11 depicts the activities that Nevada's principals perceived they are involved in to implement Nevada science standards. This table, in addition, illustrates science teachers' perceptions of instructional leadership behaviors demonstrated by their principal at their school. Positive responses, such as agree and somewhat agree imply that these instructional leadership behaviors were demonstrated by the
### Table 11

#### Instructional Leadership Results Summary

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(and science teachers) work collaboratively (with science teachers) implementing Nevada science standards.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#35*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#36*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#37*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#38*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#39*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#40*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#41*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#42*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#43</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Question</th>
<th>Teacher Response</th>
<th>Administrator Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>#44* dialogue(s) openly and frequently with science teachers about science instruction.</td>
<td>10% 24% 26% 21% 19%</td>
<td>27% 39% 27% 5% 2%</td>
</tr>
<tr>
<td>#45* make(s) suggestions about science lessons.</td>
<td>3% 19% 20% 25% 33%</td>
<td>21% 39% 25% 9% 5%</td>
</tr>
<tr>
<td>#46* provide(s) opportunities for peer connections among teachers.</td>
<td>9% 28% 30% 19% 14%</td>
<td>38% 46% 11% 5% 0%</td>
</tr>
<tr>
<td>#47* provide(s) feedback about science instruction.</td>
<td>8% 26% 24% 18% 24%</td>
<td>34% 50% 14% 2% 0%</td>
</tr>
<tr>
<td>#48* solicit(s) teachers' advice and opinions about classroom instruction.</td>
<td>13% 27% 20% 19% 21%</td>
<td>52% 43% 5% 0% 0%</td>
</tr>
<tr>
<td>#49* support(s) science teachers' efforts for classroom innovation.</td>
<td>24% 35% 25% 8% 9%</td>
<td>70% 29% 2% 0% 0%</td>
</tr>
</tbody>
</table>

*p<.05

administrator. Questionnaire items that measured these perceptions were the same for both science teachers and administrators, but the stem of each item was altered to reflect the individual surveyed.

For example, questionnaire items for science teachers pertaining to instructional leadership issues were stated as "At my school, the administrator(s)…" followed by questionnaire item. In contrast, administrator questionnaire items illustrating this concept were stated as "At my school, I…” followed by the questionnaire item. Significant differences were recorded (appendix VI) between science teachers and administrators for all questionnaire
items except item 43, which asked if administrators encourage science teachers to take risks.

Administrator responses indicated that the majority perceived that they were active in the functions that define instructional leadership. Seven questionnaire items had a 90% or higher favorable (either agree or somewhat agree) response frequency for participating administrators. These results indicate that administrators perceive themselves (a) encouraging teachers' reflective behavior (item 36), (b) supporting collaboration efforts among all science teachers (item 37), (c) promoting professional dialogue among science teachers (item 38), (d) promoting professional growth among teachers (item 39), (e) emphasizing teaching and learning in the science classroom (item 42), (f) soliciting teachers' advice and opinions about classroom science instruction (item 48), and (g) supporting science teachers' efforts for classroom innovation (item 49).

Furthermore, administrators were less enthusiastic in the agreement on the following four items: (a) talk to teachers to promote reflection (item 40), (b) invite science teachers to talk openly and frequently about science instruction (item 41), (c) provide opportunities for peer connections among teachers (item 46), and (d) provide feedback about science instruction (item 47). Administrator B (medium school) responded that, "they're [science teachers] really getting together, discussing all their units, their plans, and starting to ...made a lot of dialogue between teachers." Administrator B (medium school) suggested providing peer connection opportunities by stating, "We spent a whole day at our
feeder school where we met and worked with our...teachers and their staffs for a full day. Discussed what our scores and needs were and what their scores and needs were. Looking at our students and trying to figure out what different trends we were seeing and working on what seemed to be missing.” However, science teacher C (large school) responded that, “…we do have a half day in-service [with feeder school] with them once a year, but even then you don’t get a whole lot done in half day.”

Sixty-one percent or more of science teachers agreed or somewhat agreed that administrators (a) support collaborative efforts among all science educators (item 37), (b) promote professional growth among teachers (item 39), and (c) emphasize teaching and learning in the science classroom (item 42). These items showed the highest frequency of positive science teacher responses for items in the instructional leadership category. However, in contrast, 96% or more of administrators responded favorably to these items. As shown by Table 11, significant differences exist between science teachers and administrators for each of these items. Asked if administrators support collaborative efforts among science teachers, science teachers A (small school) and C (large school) indicated that administrators tried to accommodate them, but science teacher C (large school) stated, “We have nineteen science teachers. I think administrators are overworked. Not only does she have science, but special education and physical education, too.”

Thirty-nine percent or less of science teachers perceived that (a) administrators work collaboratively with science teachers implementing science
standards (item 35), (b) make suggestions about science lessons (item 45), (c) provide opportunities for peer connections among teachers (item 46), and (d) provide feedback about science instruction (item 47). These responses further illustrate the dissimilarity between science teacher and administrator perceptions.

Sixty percent or more of responding administrators, however, perceived exhibiting the instructional leadership behaviors that 39% or fewer of science teachers perceived they did.

Science teachers and administrators have a significantly different perception of instructional leadership at their school. The only instructional leadership category item that did not show a significant statistical difference was regarding administrators encouraging science teachers to take risk in standards implementation (item 43).

Research Question Three

School Size

Research question three asked "Are there differences in perceptions among science teachers and principals at small, medium, and large schools?" These perceptions regard the impact of Nevada science standards. This question was answered by investigating each of the following categories: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, and (f) supervision. This question illustrated if perceptions among science teachers and administrators differ based on school size. Means were used to compare perceptions and significant differences noted (see Appendix VI).
Means were computed based on individual responses on the Nevada science standards questionnaire. Responses ranged from (1) disagree to (5) agree on a Likert scale. Analysis of variance was performed to determine if a significant difference existed among science teachers at small, medium, and large school. Those responses that were significant ($p<.05$) were noted and appendix VI displays ANOVA results. School size was defined as the total student enrollment at a school. Small schools had an enrollment of 900 or fewer, medium 901 – 1999, and large schools had an enrollment of 2,000 or greater. Table 12 illustrates the results among science teachers and administrators at small, medium, and large schools.

Nine questionnaire items showed a significant statistical difference among science teachers in small, medium, and large schools. These items asked if Nevada science standards (a) hold students accountable (item 2), (b) assist teachers in holding administrators accountable (item 5), (c) assist students in holding themselves accountable (item 9), (d) are understood by science teachers (item 18), (e) are understood by administrators (item 19), (f) are a priority (item 20, (g) encourage professional dialogue among teachers (item 21), (h) have been implemented (item 23), and (i) provide common expectations for student achievement (item 33).

Two questionnaire items showed a significant difference among the perceptions of small, medium, and large school principals. These referred to Nevada science standards impact on (a) assisting in holding students accountable for developing certain knowledge and skills (item 2), and
Table 12

Science Teachers and Administrators’ Mean Responses Based on School Size

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Science Teachers</th>
<th>Administrators</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small School</td>
<td>Medium School</td>
</tr>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td>2.95 2.69 3.07</td>
<td>3.69 3.58 3.61</td>
</tr>
<tr>
<td><strong>Instruction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#17 help develop interdisciplinary approaches to content areas.</td>
<td>2.95 2.69 3.07</td>
<td>3.69 3.58 3.61</td>
</tr>
<tr>
<td>#22 have positively impacted science instruction.</td>
<td>3.23 3.13 3.03</td>
<td>4.07 4.00 3.92</td>
</tr>
<tr>
<td>#25 guide lesson plan development.</td>
<td>3.83 4.13 3.75</td>
<td>4.21 4.11 4.07</td>
</tr>
<tr>
<td>#27 have a positive impact on science instruction.</td>
<td>3.30 3.13 3.10</td>
<td>4.09 3.88 4.00</td>
</tr>
<tr>
<td>#29 allow science teachers to emphasize teaching and learning.</td>
<td>3.04 2.98 2.89</td>
<td>4.08 3.81 3.92</td>
</tr>
<tr>
<td>#33 provide common academic expectations for all students.</td>
<td>3.69* 4.00* 3.47*</td>
<td>4.43 4.29 4.30</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#10 are used to design student assessment programs in science classes.</td>
<td>3.51 3.64 3.28</td>
<td>4.09 3.82 3.84</td>
</tr>
<tr>
<td>#16 help improve academic achievement of students.</td>
<td>3.16 2.97 3.00</td>
<td>4.22 4.00 4.15</td>
</tr>
<tr>
<td>#32 assist students in learning science.</td>
<td>3.02 2.91 2.90</td>
<td>4.00 3.64 4.07</td>
</tr>
<tr>
<td>#34 reflect our expectations for student achievement.</td>
<td>3.55 3.44 3.26</td>
<td>4.30 3.94 4.07</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Accountability</th>
<th>#2</th>
<th>assist in holding students accountable for developing certain knowledge and skills.</th>
<th>3.67* 3.79* 3.14*</th>
<th>4.13 4.23 4.23</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3</td>
<td>assist administrators in holding teachers accountable for student learning.</td>
<td>3.58 3.35 3.20</td>
<td>4.08 3.82 4.15</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>assist administrators in holding teachers accountable for instructional improvement.</td>
<td>3.27 3.41 3.18</td>
<td>4.26 3.82 4.23</td>
<td></td>
</tr>
<tr>
<td>#5</td>
<td>assist teachers in holding administrators accountable for student learning.</td>
<td>3.06* 2.44* 2.43*</td>
<td>3.65* 2.94* 3.92*</td>
<td></td>
</tr>
<tr>
<td>#6</td>
<td>assist teachers in holding administrators accountable for instructional improvement.</td>
<td>2.88 2.53 2.55</td>
<td>3.86 3.23 3.76</td>
<td></td>
</tr>
<tr>
<td>#7</td>
<td>assist administrators in holding parents accountable for student learning.</td>
<td>2.52 2.25 2.21</td>
<td>2.56 2.41 3.23</td>
<td></td>
</tr>
<tr>
<td>#8</td>
<td>assist teachers in holding parents accountable for student learning.</td>
<td>2.44 2.23 1.95</td>
<td>2.47 2.52 3.30</td>
<td></td>
</tr>
<tr>
<td>#9</td>
<td>assist students in holding themselves accountable for themselves.</td>
<td>3.04* 3.14* 2.41*</td>
<td>3.69 3.41 3.46</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional Development</th>
<th>#13</th>
<th>are used to design science professional development programs.</th>
<th>2.95 3.38 3.29</th>
<th>4.18 3.88 4.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>#18</td>
<td>are understood by science teachers.</td>
<td>3.54* 3.95* 3.34*</td>
<td>3.60 4.29 3.69</td>
<td></td>
</tr>
<tr>
<td>#19</td>
<td>are understood by administrators.</td>
<td>3.28* 3.19* 2.56*</td>
<td>3.78 3.70 3.61</td>
<td></td>
</tr>
<tr>
<td>#21</td>
<td>encourages science teachers to promote professional dialogue among them.</td>
<td>2.86* 3.52* 2.91*</td>
<td>3.95 4.00 4.00</td>
<td></td>
</tr>
<tr>
<td>#31</td>
<td>promote group development among science teachers.</td>
<td>2.93 3.42 3.13</td>
<td>3.78 4.12 3.84</td>
<td></td>
</tr>
<tr>
<td>Curriculum</td>
<td>#1 have established common expectations to guide curriculum development.</td>
<td>3.81</td>
<td>4.04</td>
<td>3.84</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>#14 match our goals for what we want and expect from science curricula.</td>
<td>3.48</td>
<td>3.07</td>
<td>3.09</td>
<td>4.08</td>
</tr>
<tr>
<td>#15 guide our goals for what we want and expect from science curriculum.</td>
<td>3.74</td>
<td>3.41</td>
<td>3.37</td>
<td>4.43</td>
</tr>
<tr>
<td>#20 are a priority.</td>
<td>3.69*</td>
<td>3.89*</td>
<td>3.09*</td>
<td>4.08</td>
</tr>
<tr>
<td>#23 have been implemented into our science curricula.</td>
<td>4.11*</td>
<td>4.35*</td>
<td>3.96*</td>
<td>4.47</td>
</tr>
<tr>
<td>#30 are aligned with our current science curricula.</td>
<td>3.86</td>
<td>3.65</td>
<td>3.51</td>
<td>4.00</td>
</tr>
<tr>
<td>Supervision</td>
<td>#11 are used to assist teacher supervision in science classrooms.</td>
<td>2.69</td>
<td>2.65</td>
<td>2.73</td>
</tr>
<tr>
<td>#12 are discussed during teacher evaluation conferences.</td>
<td>2.58</td>
<td>2.80</td>
<td>2.78</td>
<td>3.68</td>
</tr>
<tr>
<td>#24 are used to supervise teacher performance.</td>
<td>2.74</td>
<td>3.17</td>
<td>2.96</td>
<td>3.36</td>
</tr>
<tr>
<td>#26 have had a positive impact on classroom supervision.</td>
<td>2.58</td>
<td>2.48</td>
<td>2.62</td>
<td>3.36</td>
</tr>
<tr>
<td>Instructional Leadership</td>
<td>At my school, the administrator(s).../ At my school, I... #35 (and science teachers) work collaboratively implementing Nevada science standards.</td>
<td>2.58</td>
<td>2.56</td>
<td>2.55</td>
</tr>
<tr>
<td>#36 encourage(s) teachers’ reflective behavior (i.e., planning more carefully, responding to student diversity).</td>
<td>2.89</td>
<td>3.04</td>
<td>2.81</td>
<td>4.34</td>
</tr>
<tr>
<td>#37 support(s) collaborative efforts among all science educators.</td>
<td>3.49</td>
<td>3.94</td>
<td>3.51</td>
<td>4.56</td>
</tr>
</tbody>
</table>
#38  
**promote(s) professional dialogue among science teachers.**

3.29 3.61 3.28 4.43 4.58 4.23

#39  
**promote(s) professional growth among teachers (i.e., workshops, training, etc.).**

3.52 3.26 3.21 4.47 4.70 4.53

#40  
**talk(s) to teachers to promote reflection.**

2.75 2.75 2.66 4.30 4.41 4.00

#41  
**invite(s) science teachers to talk openly about science instruction.**

2.86 3.05 2.83 4.47 4.41 4.00

#42  
**emphasize(s) teaching and learning in the science classroom.**

3.49 3.42 3.22 4.68 4.64 4.38

#43  
**encourage(s) science teachers to take risks (i.e., different instructional strategies, alternative assessment, etc.).**

3.04 2.84 2.75 4.43 4.29 4.00

#44  
**dialogue(s) openly and frequently with science teachers about science instruction.**

2.62 2.63 2.41 3.91 3.94 3.69

#45  
**make(s) suggestions about science lessons.**

2.41 2.22 2.40 3.78 3.41 3.61

#46  
**provide(s) opportunities for peer connections among teachers.**

2.88 2.95 3.02 4.21 4.23 4.07

#47  
**provide(s) feedback about science instruction.**

2.76 2.75 2.79 4.26 4.11 4.07

#48  
**solicit(s) teachers' advice and opinions about classroom instruction.**

2.95 3.16 2.71 4.47 4.47 4.38

#49  
**support(s) science teachers' efforts for classroom innovation.**

3.88 3.59 3.39 4.69 4.70 4.61

*£<.05

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(b) principals working collaboratively with science teachers in implementing standards.

In the instruction category, there was a significant difference among small, medium, and large school science teachers' perceptions that Nevada science standards provide common academic expectations for all students (item 33). Large school science teachers reported a lower mean response than small and medium school science teachers did for this item. Referring to lower ability level students, science teacher C (large school) suggested, "They still get standards testing. They can use notes, worksheets, anything that we have worked on...I can't really give them quote-unquote homework due the next day because I won't get any back...."

Three questionnaire items in the accountability category illustrated a significant difference among small, medium, and large school science teachers regarding the impact of Nevada science standards. These questionnaire items asked if Nevada science standards (a) assist in holding students accountable for developing certain knowledge and skills (item 2), (b) assist teachers in holding administrators accountable for student learning (item 5), and (c) assist students in holding themselves accountable for themselves (item 9). Large school science teachers, responding to these items, reported a lower mean response than science teachers at small or medium schools did. Responding if Nevada science standards assisting students in holding themselves accountable, science teacher A (small school) stated, "Unfortunately it seems over the last couple of years...this is the consensus among all of us...the kids are just getting lazier."
Asked if Nevada science standards assist teachers in holding administrators for student learning, science teacher B (medium school) responded, "I don't know if they'll make any huge change. It depends mostly on how it affects the test scores" and "The Nevada science proficiency is the only thing that will promote greater accountability for administration...parental pressure on proficiency scores."

Three questionnaire items illustrated a significant difference in perception among science teachers from small, medium, and large schools regarding Nevada science standards impact on professional development. These items asked if Nevada science standards (a) are understood by science teachers (item 18), (b) are understood by administrators (item 19), and (c) encourage science teachers to promote professional dialogue among themselves (item 21). Large school science teachers reported the lowest means for items 18 and 19. Science teacher C (large school) acknowledged, "I think we do a lot...maybe not school based, but I think the school district offers a lot of stuff for teachers to take. I did take the BAM workshop and I am trying to familiarize with it a little more. It is hard, but it is my own fault. I seem stuck in my routine already and to change it is kind of a pain." When asked if administrators understand science standards, science teacher C (large school) expressed, "I don't think administrators get the jest of what is happening in the classroom."

In contrast, medium school science teachers reported that Nevada science standards promote professional dialogue among themselves. Science teacher B (medium school) implied that standards are discussed during all
department meetings and that substantial department time has been devoted to rewriting curriculum.

Two questionnaire items showed a significant difference in perceptions among science small, medium, and large school science teachers regarding the impact of Nevada science standards impact on curriculum. These questionnaire items asked if Nevada science standards items (a) are a priority (item 20) and, (b) have been implemented into our curriculum (item 23). Compared to small and medium school science teachers, large school science teachers reported the lowest mean for each item. Responding to standards’ impact on curriculum, science teacher C (large school) reported, “I think that…basically by us aligning our classes with our benchmarks and these being aligned with science standards is basically the jest of it, but I know each teacher does their own thing whenever they think that’s its right…I haven’t seen a whole lot of change.” However, science teacher A (small school) addressing the same question stated, “In fact, we’ve totally restructured our science program in that we’re on block schedule part of which is a semester block and because there are three major strands [earth science, life science, and physical science]... We now make sure that by the end of the 10th grade year a student has taken a high school course in each one of those strands.”

Two questionnaire items showed a significant difference among small, medium, and large school administrators’ perceptions regarding the impact of Nevada science standards. Table 12 illustrates the responses to these two items. Perceptions differed in the accountability and instructional leadership
categories. From the accountability category, item 5 asked if the Nevada science standards assist teachers in holding administrators accountable for student learning. Medium school administrators reported the lowest mean among the groups, indicating their perception is different from small and large school administrators. However, administrator C (large school) suggested, "We're accountable for everything all the time" and also adding, "We try to hold kids accountable for their learning. I think we always have you know there is some resistance to that philosophy, but I think through educational history we try to hold kids accountable for their learning."

Regarding instructional leadership behaviors, the perceptions of small, medium, and large school administrators differed in that small and medium school administrators suggested working collaboratively with science teachers implementing Nevada science standards (item 35); in contrast, large school administrators did not share this perception. Large school administrators' perception significantly differed from small and medium school administrators. Administrator C (large school) conceived that, "When you sit down and prioritize the things you got to do, it [instructional improvement time] receives the amount of time that you can devote to it, but it doesn't receive the amount of time that it needs." Conversely, the medium school administrator added, "I make a couple of classroom visits a day."

Science teachers and administrators during the interview were asked for positives and negatives about school size. Although ideal school size varied from "800 maximum" as indicated by science teacher B (medium school) to
administrator B (medium school) suggesting, "I think between 2,200 – 2,400 is good," the majority of respondents suggested that smaller schools have benefits not afforded students at larger schools. Science teacher B (medium school) submitted the following: (a) "Participation in everything is up because kids felt that they can compete," (b) "School size allows us to stay on top of the student;" and, (c) "In a big school kids get lost. I don't see how standards could be implemented in large classes." Adding to these comments about school size, science teacher C (large school) stated, "I think you'd probably get more one on one help. I think you'd get to know the parents along with the students."

Administrators also shared the perception that school size was an important issue. Administrator A (small school) surmised that "chance for leadership [increases]. It is nice to be in a small community where kids run into teachers after school. Teachers know mom & dad. If teachers know mom & dad on a first name basis, it's hard for kids to play games" and also adding "At my high school...every single one participates in at least one extracurricular activity or club." Administrator C (large school) presented, "This year we had 2,800. It is a lot of kids to manage. There are kids that go through that school with no one ever knows or recognizes. A much smaller size, you may have that element, but smaller." Administrator C (large school) surmised that, "Too many kids slip through the cracks. There is too broad a scope of activities for each to concentrate on little things [referring to administrators] that you need to do. The personal things between students and teachers and administrators..."
Summary

The collected data illustrated the following patterns. Administrators were more positive about standards than science teachers were in general. School size largely did not matter when administrators and science teachers responded to the impact of Nevada science standards, although size had a greater affect on teachers' perceptions. The respondents' role had a more significant impact. Administrators and science teachers perceived the impact of Nevada science standards differently in all categories: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum; and, (f) supervision. Regarding these categories, administrators, however, perceived themselves as instructional leaders while science teachers disagreed. In addition, a paradox existed between the crux of standards and proficiency testing.
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This study examined the perceptions of science teachers and principals regarding the impact of Nevada science standards on the following categories: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum; and, (f) supervision. Furthermore, this study described instructional leadership behaviors that administrators perceived performing and science teachers' perceptions of these behaviors. Finally, the studied answered if the perceptions of science teachers and administrators' at small, medium, and large schools differed regarding the aforementioned categories.

National science standard documents have been written that seek to improve student achievement. Nevada has authored its own state science standards that have been implemented across the state since 1998. These science standards were designed to impact instruction, assessment, accountability, professional development, curriculum, and supervision. Since science teachers are directly involved with implementing standards within their classroom and administrators, acting as instructional leaders, are directly involved too, the perceptions of science teachers and administrators about
Nevada science standards are important if these standards will be successful or not in Nevada's classrooms.

Methodology

The Nevada science standards questionnaire (Appendix I) was developed to elicit science teachers' and administrators' perceptions regarding the impact of Nevada science standards. Forty-nine questionnaire items measured the perceived impact on the following categories: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, (f) supervision; and, (g) instructional leadership. Respondents were asked to indicate their level of agreement to each item by utilizing a Likert scale ranging from 1 (disagree) to 5 (agree). The questionnaire also included seven demographic variables: (a) gender, (b) position – teacher or administrator, (c) number of science courses completed, (d) teaching experience, (e) administrative experience; (f) school enrollment. These demographic variables served to provide a further, in-depth description of the population studied.

In conjunction with the questionnaire, a semi-structured telephone interview, consisting of seven items with appropriate probing questions, was created to gather in-depth information from selected respondents to describe further the population under study. Due to the geographical distribution of high schools in Nevada, telephone interviews were advantageous for the study as opposed to face-to-face interviews (Gall, Borg & Gall, 1996; McMillan & Schumacher, 1984). In addition, the telephone interview proved to be an
appropriate method in order to gain further in-depth information regarding the perceptions of science teachers and administrators of the impact of Nevada science standards.

The telephone interviews were conducted with three high school science teachers and three high school administrators. From these six individuals, there was one science teacher and one administrator representing a small, a medium, and a large school as defined by the school's student enrollment. These individuals were randomly selected by examining the returned questionnaires. Each questionnaire included a section for an individual to volunteer and to indicate an appropriate time to be contacted. However, the large school administrator interviewed was a forced selection because only one large school administrator volunteered to participate in the telephone interview. Each interview lasted approximately 45 minutes.

During the telephone interviews, participants were asked at the beginning of the telephone interview if they agreed to the interview being recorded in order to ensure accurate data analysis. All individuals gave the researcher permission to record the interview. In addition, confidentiality was guarded at all times and participants were informed that they could terminate the interview at any time.

The data received from the questionnaire and the telephone interviews were utilized to triangulate the data. The notion of triangulation was based on the presumption that any bias pertinent to one form of methodology or instrument would be limited by the use of another methodology or instrument (Creswell, 1994). In addition, this study utilized the dominant-less dominant design as
discussed by Creswell (1994). The dominant-less dominant design created an opportunity for the researcher to utilize a dominant design with a small component of the study drawn from another design (Creswell, 1994, p. 177). The advantage to this approach was that it used one design to provide a consistent representation of the study and yet it gained further detail by using another design (Creswell, 1994, p. 177). The dominant instrument in this study was the Nevada science standards questionnaire. The less-dominant method was the six telephone interviews conducted with randomly selected science teachers and administrators representing small, medium, and large Nevada high schools.

A pilot study was conducted at a large, suburban Nevada high school involving 18 individuals. Initiating the process, the building's principal received the Nevada science standards questionnaire packet. This packet included an introductory letter with instructions, twenty science teacher questionnaires, two administrator questionnaires, and a stamped, addressed return envelope. The first mailing resulted in 17 returned questionnaires, a 95% return rate. One suggestion for improvement was received. This concerned a clarification of language on a questionnaire item, which was immediately corrected.

Based on the responses from the questionnaire, telephone interview questions were formed that would further describe perceptions of Nevada science standards. The researcher also conducted a pilot test of the telephone interview prior to beginning actual data collection. One individual was randomly selected from the pilot group. Confidentiality assurances were given to the
Discussion of Findings

Glasman and Heck (1992) reported that there is a long-standing belief in educational wisdom that principals have an impact on schools. The school leadership literature has focused on instructional leadership's impact on schools. Instructional leadership has focused on a principal's efforts to establish school goals, align its curriculum, develop a safe school environment, and supervise classroom instruction (Heck & Hallinger, 1999). Cuban (1990) implied that this concept of school leadership portrayed principals as intimately involved in instruction. In addition, Fredricks and Brown (1993) suggested that instructional leadership is the crucial link between the principal's activities and the school's effectiveness.

Inger (1993) further added that current major educational reform calls for meaningful, extensive collaboration among teachers and administrators. This collaboration is seen as the link between effective teaching and learning (Edmonds, 1982). Principals, acting as instructional leaders, are needed to facilitate the implementation of Nevada science standards.

Nevada science standards were implemented by the Nevada state legislature in 1998. Based on national science standards, these standards sought to define what Nevada science students should know and be able to do at the completion of each grade level. In addition to the education of students,
these standards aimed to modify school instruction, assessment, accountability, professional development, and supervision (Nevada Department of Education, 2000). However, all these areas are also affected by instructional leadership behaviors (Blase & Blase, 1999b; Bossert, Dwyer, Rowan, & Lee, 1982; Gantor, Daresh, Dunlap, & Newsome, 1999; Glickman, 1985; Pajak, 1989). Again, as Edwards (1982) asserted, it is through these behaviors, coupled with collaboration with teachers that leads to effective teaching and learning. For the Nevada science standards to fulfill their goals, principals and science teachers must have a shared understanding of the role standards will play in curriculum development and instruction (Anderson, 1996). However, the study showed that administrators and science teachers' perceptions of the impact of Nevada science standards differed significantly. Findings from this study, however, showed significant differences in all the following areas: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, (f) supervision; (g) and, instructional leadership.

Research Questions One and Two

Research questions one and two will be discussed together since instructional leadership is inextricably tied to the issues of supervision, instruction, professional development, curriculum, assessment, and accountability. In fact, each of these constraints is essential to the tasks of instructional leadership. Regarding supervision, Sergiovanni (1985) noted that the theoretical perspectives of supervision do not fit the realities of supervisory
practice. Sergiovanni (1985) argued that these theoretical perspectives “favor abstract views and deterministic prescriptions that do not reflect the actual world of supervision, and therefore are not very useful in and of themselves” (p.17). Zepeda and Ponticell (1998) further stated that traditionally, supervision has been confused with evaluation, a function aimed at determining continued employment. Levin, Hoffman, and Badiali (1987) found that supervision was most helpful for teachers when teachers understood that the supervision process was intended to assist them in the improvement of teaching, when teachers and administrators jointly identified changes needed in instruction, and when administrators understood teachers’ instructional objectives.

However, based on the interview and questionnaire data collected, supervision in Nevada’s high schools is practiced, as Reitzug (1997) suggested, as discrete interventions that begin and end at a particular time and that are imposed on teachers. These discrete interventions include the traditional pre-evaluation conference at the beginning of the school year and subsequent classroom visitation. These practices illustrate the confusion between practices of supervision and evaluation among principals and the dominance of evaluation over supervision. Supervision is practiced as a “to do” list, not as a continuous process in schools. Only 22% of science teachers felt standards had a positive impact on classroom supervision while 53% of administrators felt that science standards did have a positive impact on supervision.

Administrator A (small school) indicated that, “[Nevada science standards] it’s not a big part of the evaluation yet.” Also, supporting Reitzug’s (1997)
assertion, administrator C (large school) added, "I would say more than anything else during pre-observation conferences at the beginning of the year when we're talking to teachers about curriculum that's the time we talk about standards and how they're doing that. After that the evaluation is more about what is happening in the classroom, classroom discipline, classroom management, lesson plans..."

Standards seemingly are treated as discrete units that have no direct affect on classroom practice. Science teachers further commented on this situation.

For example, science teacher A (small school) discussed his evaluation by saying, "Two years ago on my evaluation in the needs to improve section, the individual [administrator] had stated, 'and make sure that you are covering the state standards.' Well, the only problem is...that is a great thing to say, fine. Have you asked me? You have not. Had you looked in my lesson plan you would have seen a copy of the curriculum that is based on standards and a check next to each state standard that were taught...anyway." This example suggested that supervision, in general, is practiced in discrete units. Indicating that supervision is approached in a piecemeal fashion, administrator A (small school) stated, "...first of all, just putting standards into the hands of teachers and then say you'll be accountable for this...and teaching how to plan and teach the new standards..." Interviews with both administrators and science teachers indicated supervisory practices focus on evaluation and summative functions as opposed as a practice to enhance teaching and learning.

Teaching the new standards as the National Research Council (1996) stated requires science teachers to plan inquiry-based science programs. In
addition, science standards require substantial changes in how science is taught. Responding to the impact of Nevada science standards on instruction, administrators and science teachers perceived that Nevada science standards do guide lesson plan development. Science teacher C (small school) stated, “I’ve had to go back and use benchmarks and make sure my daily objectives are matching with science standards and curriculum goals” and science teacher B (medium school) added “I think I copy the backward assessment model (BAM) quite a bit more...” Nevada science standards have affected how teachers plan their daily lessons. However, although the daily lesson plans have been affected, science teachers and administrators differ regarding if Nevada science standards have had a positive impact on science instruction. Forty-six percent of science teachers perceive a positive impact whereas 77% of administrators perceived a positive impact on instruction. Science teacher A (small school) suggested “It [Nevada science standards] has limited my personal freedom to teach...therefore in many ways has limited my choices of what I think is appropriate.” In addition, science teacher C (large school) added “Everyday I have to put corresponding numbers to go with standards. I hate it.”

Nevada science standards seek to impact classroom instruction practices. However, the teacher interview data suggested that Nevada science standards encourage a lack of individual change. Science teachers indicated more concern over documenting standards than developing innovative instructional strategies. In addition, science standards encourage paperwork over real change in the classroom. Supporting the interview assertions, 39% of responding science
teachers agreed or somewhat agreed that Nevada science standards emphasized teaching and learning and 42% indicated that science standards have positively impacted science instruction.

In contrast to science teachers, administrators perceive Nevada science standards impact on instruction differently than teachers. Seventy-three or more of administrators responded favorably when asked if Nevada science standards positively impacted science instruction and emphasized teaching and learning. Administrator C (large school) suggested that Nevada science standards have positively impacted classroom instruction by saying “…I think what they've [Nevada science standards] done is made our curriculum a little more consistent across the board.” Agreeing, administrator A (small school) suggested “I would say that it has given science a little more focus…instead of hit or miss, it's a little more directed.” Also, administrator A added “instructional methods would be the thing that has changed most. The idea of starting with a concept in mind and working backward towards it…is planning in the BAM model.” The National Science Teachers Association (1993) observed that the typical U.S. science program discourages real learning because the programs rely on fact and inhibits students from making real world connections. Standards have not relieved this dilemma.

As Cohen and Ball (2001) implied instruction consists of interaction between teachers, learners, content, and environments over time. Simply placing numbers in the margin of a lesson plan book will not change instruction.
As the National Research Council (1996) suggested, reforming science education requires substantive changes in science instruction.

In order for teachers to change instruction, there must be a thorough understanding of what the standards imply. This requires equally substantive change in professional development practices at all levels (NRC, 1996, p.5). The National Research Council (1996) further added, "[Teachers] should be provided opportunities to develop theoretical and practical understanding and ability, not just technical proficiencies.

Thus, time is viewed as a critical component to instructional improvement (Cohen & Ball, 2001; NRC, 1996). As indicated by interview data, time was provided for professional development at Nevada high schools. For example, administrator B (medium school) said, "We spent a whole day over with feeder middle school where we met with and worked with our...teachers and theirs for a full day. Discussed what our scores and needs were and what their scores and needs were. Looking at our students and trying to figure out what different trends we were seeing and working on what seemed to be missing. We did a lot. The day was wonderful. The teachers said it was the best day ever spent as far as staff development." However, one day or two days spent over the course of a school year discussing curriculum and talking to colleagues is inadequate. Pajak (1993) surmised that professional development is the most important aspect of instructional leadership.

The Nevada Education Reform Act stated that Nevada science standards would provide common expectations to guide instruction. Science teachers and
administrators agree that it does. However, as applied to Nevada classroom instruction, teachers perceive standards dissolve their autonomy as professionals. In addition, all interviewees mentioned that lesson plans were guided by being benchmarked to local curricula and Nevada science standards. Placing numbers in a lesson plan book does not constitute an innovative approach to instruction, aimed at improving student achievement. In fact, this demonstrates the confusion between curricula alignment issues and instructional approaches by science teachers. In supporting this assertion, 59% of science teachers indicated understanding science standards, compared to 75% of responding administrators. This apparently piecemeal approach to standards-based instruction violated what national science standard documents defined as standards based instructional improvement (NRC, 1996). Change toward standards based instruction requires changes in assessment methods.

Questionnaire items asked how Nevada science standards are used to design student assessment programs, help improve the academic achievement of students, assist students in learning science, and reflect our expectations for student achievement. Administrators and science teachers responses indicated that perceptions differed on Nevada science standards helping to improve academic achievement of students (item 16) and assisting students in learning science (item 32). Administrator interviews indicate that they perceived science achievement in terms of students' performance on the state mandated science proficiency test. Administrator B (medium school) suggested “…they [science teachers] may be structuring their questions a little differently on their teacher
made tests so they're [science teachers] a little closer in line with what would be on the state standardized test." However, administrator C (large school) added "...teachers are still giving tests...still utilizing techniques that you use to determine what those kids are learning in the classroom. I'm not sure that testing assessment procedures have changed."

National science standards emphasize authentic assessment techniques that utilize laboratory-based inquiry to measure student understanding of scientific concepts (NRC, 1996). Nevada science standards attempt to do the same. However, science teacher A (small school) stated, "I think there's more emphasis on lab now, more performance lab. Maybe I am old fashioned, but I find lab to be especially time consuming since so much of the curriculum to be fact based. I find lab to be a very inefficient method for teaching that." Science teacher C (large school) described standards-based assessment practices in a class for lower level students by stating, "They still get standards testing. They can use notes, worksheets, anything that we have worked on...I don't really give them quote-unquote homework due the next day because I won't get any back."

These comments seem to be the antithesis of the national science standards goals (NRC, 1996), but do indicate that Nevada science standards provide common expectations to guide student assessment programs, at least toward the state proficiency examination. There apparently is confusion about what to assess and how to assess it with the classroom.

As indicated by teacher and administrator comments, current student assessment practices seem to be traditional assessment practices, not novel.
approaches to assessment. Administrator C (large school) added, "I hate to see us have dictated everything they [teachers] do. It takes away a little bit of your freedom and a little bit of your spontaneity and that's not good." Adherence to standards in response to accountability issues seemingly has curtailed teacher innovativeness and their emphasis on teaching and learning.

This could be in response to the accountability system that has been coupled with Nevada science standards. Currently, Nevada high school students are required to pass a standardized exam as a graduation requirement. By 2005, all Nevada science students are required to pass a science proficiency exam based on state standards as a graduation requirement. This accountability system has blurred the distinction between the intent of standards (Nevada Department of Education, 2000; NRC, 1996). When asked about the impact of science standards on their schools, both science teachers A (small school) and B (medium school) mentioned how well their students had performed on the state standardized test. Each administrator responded to the similar question by suggesting that instruction, curriculum, and assessment practices in the classroom prepare students for this exam.

These individuals will be held accountable for the performance of their students on this exam. However, Adams and Kirst (1999) implied that such accountability measures "introduce internal contradictions that draw attention away from important accountability goals" (p.473). Accountability draws the focus from standards that improve teaching and learning to a focus on performing as well on the state mandated exams. In essence, accountability has
defeated the intention of standards. Instead of standards that promote classroom innovation and higher student achievement, standards become the means to meet an end. This end is measured by one high stakes accountability test. The results of which are published for the public to draw conclusions about their local schools. This accountability system favors bureaucratic rules and regulations at the expense of real change within the classroom.

Elmore and Fuhrman (2001) reported that measuring performance and coupling it with rewards and sanctions would cause schools and the individuals who work in them to perform at higher levels. This process underpins the performance-based accountability systems. However, accountability, as currently practiced, does not allow individuals to take risks. According to Zepeda and Ponticell (2001) freedom to fail is an important condition to move teachers from willingness to change to action. Accountability removes the willingness to change because change may bring failure that cannot be allowed under the present accountability system. As Adams and Kirst (1998) remarked, “accountability systems pose tradeoffs between operational values...as bureaucratic systems set up artificial tensions between accountability and values such as creativity and innovation”(p.473).

The questionnaire data suggested that principals perceived themselves as instructional leaders. Administrators indicated practicing behaviors associated with instructional leadership such as supporting collaboration efforts between all science educators, promoting professional growth among teachers, dialoging openly and frequently with science teachers about science instruction, and
promoting professional dialogue among science teachers. For example, administrator A (large school) acknowledged, “What it [Nevada science standards] has done has brought us all together and we’re on the same page so to speak. I don't know if we weren't doing that before then, but at least now we know we're doing it.” However, science teachers indicated that their administrators did not behave as instructional leaders to the degree that administrators claimed. In fact, the questionnaire items measured a significant difference between administrators and science teachers’ perceptions about instructional leadership behaviors. This indicates that administrators and science teachers perceive different realities in all arenas as measured by the Nevada science standard questionnaire and interview data.

Heck and Hallinger (1998) concluded that principal leadership has an indirect effect on student outcomes via a variety of behaviors. The questionnaire results indicated that administrators and science teachers have a different frame of reference regarding the impact of Nevada science standards in Nevada high schools. This frame of reference difference may exist due to the different roles played by administrators and science teachers. Principals perhaps focus on the entire school, not just on the science instruction and curriculum. As administrator C (large school) stated, "That science standards are no more important to his school than English or math standards.” This comment suggested that principals practice a holistic approach to school leadership. Science represents only one of many of the facets of a school’s academic program. Administrators need not concern themselves about the minutiae of science standards. These individuals
perceived that they simply need to place standards into the hands of science teachers, provide a few professional development opportunities, and standards will take care of themselves.

Science teachers perhaps possess a myopic school view, placing utmost importance on their specific subject at the expense of other school disciplines and activities. These perceptions manifested themselves in the teacher questionnaire responses and interviews. Science teacher C (large school) implied that a supervising administrator proficient in science would be preferable to one without a science background. Science teacher B (medium school) believed that the administration did not know what was going on with the science curricula. Regardless, science teachers and administrators do differ significantly in their perceptions of the impact of Nevada science standards. The boundaries between principals and teachers promote this different view of a school's reality.

A lack of intelligent conversation about instruction could explain this difference in perceptions. Administrators and science teachers stated discussing standards during the evaluation process. However, this discussion focused on the summative portion of the supervision process. This initial conversation most likely represented the only dialogue between a science teacher and an administrator about science standards and their impact. This type of supervision has been described by Zepeda and Ponticell (2001) as supervision as a meaningless/invisible routine. This routine describes a shallow and a hollow ritual where neither the supervisor nor the teacher was invested and from which nothing meaningful or useful resulted (Zepeda and Ponticell, 2001, p79). Within
this situation, administrators and science teachers are accomplices in a meaningless state mandated evaluation process.

The lack of intellectual dialogue between these participants equals the absence of promoting a process within a school. Sergiovanni and Starratt (1998) discussed that a feeling of community needs to be in place before change can occur and an effective school is established. This is based on the collegiality that can only occur in a caring and collaborative environment. Personal contacts by principals during supervisory practice shape the environment they have with teachers (Sergiovanni & Starratt, 1998). As currently practiced in the examined high schools, supervisory practices are disjointed and do not enhance teaching and learning. School size perhaps played a role in this phenomenon.

Research Question Three

Research question three asked whether the perceptions of science teachers and principals were impacted differently depending on school size. The research suggested that an individual's role, whether a principal or science teacher, was a more significant determination of one's perception of science standards than the school's size. For administrators, only 2 questionnaire items showed a significant difference in perception among administrators' from small, medium, and large schools. These results indicate that principals statewide, regardless of school size, envision standards in a similar manner.

However, the data distinguished 9 questionnaire items that demonstrated a significant difference between science teachers among small, medium, and
large schools. These items asked if Nevada science standards (a) provide common academic expectations for all students (item 33), (b) assist in holding students accountable for developing knowledge and skills (item 2), (c) assist teachers in holding administrators accountable for student learning (item 8), (d) are a priority (item 20), (e) have been implemented into our science curricula (item 23), (f) are understood by science teachers (item 18), (g) are understood by administrators (item 19), and (h) encourages science teachers to promote professional development among themselves. The difference showed that mainly large school science teachers perceived these items differently. School size had a greater impact on perceptions of science teachers from larger schools. Friedkin and Necochea (1988) noted that good school climate and instructional leadership is easier at smaller school

Overall, science teachers and administrators suggested that small schools afforded greater benefits to students than large schools. Science teacher A (small school) contended, "[at a small school] you are the power brokers. The contact is there and when something needs to be done...when you have a large district/school there is a lot of negative inertia when it is rolling. In a small group you can make the change more quickly." Science teacher C (large school) further added, "I think you'd probably get more one on one help. I think you'd get to know the parents along with the students." Administrators also had positive comments about small schools. Administrator A (small school) commented, "Kids can participate in something that makes him feels good about himself" and "Another thing is that before or after school [at a smaller school] you can spend
time with a teacher on a problem and take that one at a time. If you have 100 teachers, that's not going to happen." In addition, administrator B (medium school) spoke "...but student attitude is better in a small school." The interview data suggested consensus between science teachers and administrators regarding the benefits of small schools and negatives of large schools. Again, these negatives had a greater impact on large school science teacher's perceptions.

Science teacher A (small school) suggested that large schools have negative inertia and that change is difficult because of this. Although all organizations face dilemmas, large schools face enhanced organizational dilemmas such as the dilemma of professionalism and the dilemma of hierarchy as described by Ogawa, Crowson, & Goldring (1999). These authors submitted that the dilemma of professionalism reflects an "interweaving of bureaucratic management and professionalism in educational organizations that typically produces cross-pressures and compromises between key values but no solutions "(p.282). In schools, this could be the compromise between teaching to the test and teaching to learn new subject material.

Science teacher C (large school) illustrated the cross-pressures and compromises experienced at a large school by stating that"... size has negatively impacted it [standards]. First of all, we are over crowded. We have three science teachers out in tiny portables that is making...I do not even know how you would teach out there. It is tough to do labs. We have to juggle rooms all the time." This comment suggested that schoolteachers at larger schools have
the additional pressures of overcrowded classrooms and limited space, and, because of this, have to compromise the inquiry essence of science that promoted by the standards-based reform movement (NRC, 1996). Science teacher C (large school) also added this about a new teacher, "...in fact I know, she's a brand new teacher hired at semester. I know she is cut out a lot of stuff because it is too difficult to get organized. Her room is tiny (placed in a portable) with a lot of kids."

In addition, within school organizations, there has been a dilemma of hierarchy (Ogawa, Crowson, & Goldring, 1999). Ogawa, Crowson, and Goldring (1999) implied that this refers to top-down versus bottom-up. Administrator B (medium school) spoke of Nevada science standards being a "top-down" reform and describe Nevada science standards showing up in the mail one day. This "top-down" approach creates pressure on all school organizations, but the pressures within a larger organization are immense.

Compounding issues within large high schools is that teachers tend to be isolated from one another (Wright, 1991). Friedkin and Necochea (1988) described that good school climate and instructional leadership would be easier to achieve in small-scale schooling rather than large-scale schooling. Administrator B (medium school) intimated that in large school a department chairperson assumes many of the chores that would normally fall to the principal. Thus, the required intellectual conversation between administrators and science teachers may never occur at a large school and further the boundaries between these individuals. As Inger (1993) suggested, major educational reform requires
extensive, meaningful collaboration between science teachers and principals, a relationship lacking in the large school environment.

School size does shape instructional leadership behaviors a principal can demonstrate. Medium and large school administrators indicated supervising between 20 and 40 individuals, plus other responsibilities within the school. This confirmed Wright’s (1991) assertion that instructional leadership is a fractured and a complex process. However, Monk (1986) found that smaller schools are less complex and fragmented than larger school. Wright (1991) surmised that the amount of time devoted to instructional leadership within a school is minimal. Administrator C (large school) added, “There are only so many hours in a day. We have many administrative responsibilities other than just supervising classrooms. Now I agree with you that should be our number one priority, but, you know, it gets what time you can give it.” Administrator C (large school) further added, “Too many kids slip through the cracks. There is too broad a scope of activities for each to concentrate on little things [referring to the administration] that you need to do, [like] the personal things between students and teachers and administrators...” Science teacher C (large school) indicated that, “The size has negatively impacted it [us]. First of all, we are over crowded. We have three science teachers out in tiny portables, which is making...I do not even know how you would teach out there. It’s tough to do labs we have to juggle rooms all the time.” School size seems to impact science teachers and administrator’s perception about science standards. Science teacher A (small school) mentioned that in smaller schools there is less negative inertia and that
he is the "power broker." This statement supported Klonsky's (1995) assertion that small school size encourages teachers to be innovative and active in school processes. Thus, school size seems to further fragment and add to the complexity of instructional leadership.

Conclusion

Fletcher (1998) asked the following rhetorical question about state mandated standards: "will change follow in the classroom?" This study suggested that the changes required by Nevada science standards vary depending on whether an individual is a teacher or a principal. The interview and questionnaire data illustrated that the goals Nevada science standards attempted to impact have not been met. Answering Fletcher's rhetorical question, change has not followed state mandated standards. This study found that science teachers and principals operate in different frames of reference in terms of their teaching and supervisory practices. In fact, these frames of reference significantly differed between principals and science teachers in all research categories: (a) instruction, (b) assessment, (c) accountability, (d) professional development, (e) curriculum, (f) supervision, and (g) instructional leadership. The study found that administrators are more positive about science standards than science teachers.

This study supported Reitzug's (1997) assertion that principals practice piecemeal supervision in discrete units. Piecemeal supervision suggests that the tasks associated with supervision are accomplished in a "to do" list manner as
opposed to being an ongoing process within the school and the classroom. This supervisory approach favors state-mandated evaluation over supervisory practices that improve teaching and learning. Hence, as practiced, supervision discourages real change.

In conjunction, teachers do not understand the intention of standards. Science teachers are more concerned with the paperwork and aligning their lesson plan books with the curricula instead of practicing innovative teaching to enhance student learning. These accountability mandates have placed undue emphasis on compliance with bureaucratic rules and regulations rather than changing and improving instructional practices within the classroom. This occurs at the expense of real change. In addition, this study supported Adams and Kirst’s (1999) notion that accountability systems set up tensions that limit creativity and innovativeness. Innovativeness and creativity, combined with the freedom to fail, is an important condition if change is to occur according to Zepeda and Ponticell (2001). However, accountability does not allow individuals to experiment, to risk take, or to fail, assuring that no change occurs within classrooms occur. Thus, the current accountability system stifles the goals of the standards.

Furthermore, this study affirms that school size has an impact on science teachers and principals’ perceptions, especially the perceptions of science teachers’ at large schools. This finding supported Monk (1986), Inger (1993), and Raywid’s (1999) assertions that instructional leadership and good school climate is easier accomplished at smaller schools. In addition, Raywid (1999)
found that instructional reform contingent on school size. Science teachers' at large schools are burdened with large classes, bureaucracy, and regulations.

Overall, the significance of this study suggests to proponents of future statewide improvement initiatives that they examine how these initiatives, like standards, are applied to the schools. For example, state legislatures should consider the impact of top-down reform and accountability on schools. Also, they should take into account the affect of school size on bureaucracy that impedes change and provide adequate time for impacted parties for professional development, experimentation, and risk taking before enacting accountability measures. In conclusion, accountability and standards will not be successful unless those individuals that are impacted have time to adjust, to risk take, and to experiment. Only then will standards have their desired affects, which is improving teaching and learning.

Further Research Recommendations

As Nevada and many other states continue to emphasize and to focus on developing and implementing standards that define what students need to know and be able to do at the conclusion of each grade level, attention needs to be focused on those individuals directly impacted by these reforms. Moreover, for Nevada science standards to be successful, involvement of school personnel is crucial. Science teachers and administrators are required to address issues surrounding standards' at their school site. Since Nevada science standards attempt to effect instruction, assessment, curriculum, accountability, professional
development, and supervision, it is important to describe how science teachers and administrators perceive the impact of standards on these domains and compare their perceptions. This study determined that a difference in perception does exist between administrators and science teachers in each area that will determine how effective standards are in meeting their defined objectives. These differing perceptions indicate that a different frame of reference exists between perceived instructional leadership behaviors and their impact on teaching and learning. There is a need for a deeper understanding about science teachers' and administrators' beliefs, assumptions, values, and opinions. Future qualitative research is needed to describe these phenomena.

Implemented in 50 states, standards represent a tremendous investment in time and in money. In an effort, then, to replicate this study, it is suggested that additional states be included. Neighboring states such as California, Arizona, and Utah might be included to examine how standards have impacted their schools as well.

In addition, it is recommended that future researchers contact science teachers and administrators directly as opposed to sending a packet to one individual to disseminate the questionnaires. This may promote a higher return rate for science teachers and administrators as well as more thoughtful, honest responses.

Furthermore, this study recommends additional qualitative research to document the activities of administrators and teachers as they address state...
mandated standards to explore the possible explanations for the difference in their perceptions.

Summary

This study assessed the perceptions of science teachers and administrators regarding the impact of Nevada science standards. This study, in addition, suggested a significant difference in the perceptions of science teachers and administrators regarding the impact of standards on instruction, assessment, accountability, curriculum, professional development, supervision, and instructional leadership. While the standards movement attempts to improve the American education system, it has forgotten the individuals who will actually sustain this change - teachers and principals. These top-down reform mandates have placed an undue emphasis on bureaucratic procedures and regulations rather than changing instructional practices in the classroom. These reform mandates undermine the role of instructional leadership in schools.
APPENDIX I

ADMINISTRATOR QUESTIONNAIRE

Nevada Science Standards Questionnaire

Nevada science standards, developed by the Nevada Council to Establish Academic Standards for Public Schools, define science standards as what students know or are able to do in science at particular times in their educational careers. Please answer the questionnaire that will be used to measure the impact of Nevada Science Standards. All responses will remain confidential and anonymous. Once finished, please place in questionnaire envelope and return to your school's principal. School principals are requested to collect all questionnaires and return in provided stamped envelope by May 1, 2001.

Part I: Please circle the number that most accurately describes your professional and personal background.

A. Gender:
   1. Male  2. Female

B. Highest Level of Education:

C. Current Position: (Circle the one that most accurately describes your job).
   1. principal  2. assistant principal  3. dean

D. Number of College Science Courses Completed.
   1. 1 – 3
   2. 4 – 6
   3. 7 – 9
   4. 10 – 12
   5. 13+

E. Your School's Current Enrollment:
   1. 900 or less  2. 901 – 1999  3. 2000 or greater

168
F. Total Years Teaching Experience:  
G. Total Years Administrative Experience:  

Part II: Please answer the following questions as they currently apply to your school by circling the appropriate number. All answers have five possible responses based on a scale of 1 - 5. The scale is as follows:

- Disagree = 1
- Somewhat Disagree = 2
- Neutral = 3
- Somewhat Agree = 4
- Agree = 5

At my school, I believe Nevada Science Standards...

1. have established common expectations to guide curriculum development.
   - 1 2 3 4 5
2. assist in holding students accountable for developing certain knowledge and skills.
   - 1 2 3 4 5
3. assist administrators in holding teachers accountable for student learning.
   - 1 2 3 4 5
4. assist administrators in holding teachers accountable for instructional improvement.
   - 1 2 3 4 5
5. assist teachers in holding administrators accountable for student learning.
   - 1 2 3 4 5
6. assist teachers in holding administrators accountable for instructional improvement.
   - 1 2 3 4 5
7. assist administrators in holding parents accountable for student learning.
   - 1 2 3 4 5
8. assist teachers in holding parents accountable for student learning.
   - 1 2 3 4 5
9. assist students in holding themselves accountable for their own learning.
   - 1 2 3 4 5
10. are used to design student assessment programs in science classes.
    - 1 2 3 4 5
11. are used to assist teacher supervision in science classrooms.
    - 1 2 3 4 5
12. are discussed during teacher evaluation conferences.
    - 1 2 3 4 5

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At my school, I believe Nevada Science Standards...

13. are used to design science professional development programs
   Disagree = 1  Somewhat Disagree = 2 Neutral = 3 Somewhat Agree = 4 Agree = 5
   Agree

14. match our goals for what we want and expect from science curricula.
   Agree

15. guide our goals for what we want and expect from science curricula.
   Agree

16. help improve academic achievement of students.
   Agree

17. help teachers develop interdisciplinary (integrated) approaches to content areas.
   Agree

18. are understood by science teachers.
   Agree

19. are understood by administrators.
   Agree

20. are a priority.
   Agree

21. encourage science teachers to promote professional dialogue among themselves.
   Agree

22. have positively impacted science instruction.
   Agree

23. have been implemented into our science curricula.
   Agree

24. are used to supervise teacher performance.
   Agree

25. guide lesson development.
   Agree

26. have had a positive impact on classroom supervision.
   Agree

27. have had a positive impact on science instruction.
   Agree

28. have improved the pre-existing science curricula.
   Agree

29. allow science teachers to emphasize teaching and learning.
   Agree

30. are aligned with the current science curricula.
   Agree

31. promote group development among science teachers.
   Agree
32. assist students in learning science.  
33. provide common academic expectations for all students.  
34. reflect our expectations for student achievement.  

At my school, I  
35. work collaboratively with science teachers implementing Nevada science standards.  
36. encourage teachers' reflective behavior (i.e. Planning more carefully, responding to student diversity).  
37. support collaborative efforts among all science educators.  
38. promote professional dialogue among science teachers.  
39. promote professional growth among teachers (i.e., workshops, training, etc).  
40. talk to teachers to promote reflection.  
41. invite science teachers to talk openly and frequently about science instruction.  
42. emphasize teaching and learning in the science classroom.  
43. encourage science teachers to take risks.  
44. dialogue openly and frequently with science teachers about science instruction.  
45. make suggestions about science lessons.  
46. provide opportunities for peer connections among teachers.  
47. provide feedback about science instruction.  
48. solicit teachers' advice and opinions about classroom science instruction.
49. support science teachers' efforts for classroom innovation.

Would you like a copy of the results? Yes No

If you are willing to participate in a telephone interview, please provide the following information. All responses will be kept confidential.

First Name:_________________________________________________
Phone Number(s): (H): ___________________ (W): ________________
Best Time to Call: (H): ___________________ (W): ________________

In the provided envelope, please return the questionnaire to your school's principal. If you are the school's principal, please collect all questionnaires and return them in self-addressed stamped envelope. Thank you.

Administrator Form # _________
APPENDIX II

SCIENCE TEACHER QUESTIONNAIRE

Nevada Science Standards Questionnaire

Nevada science standards, developed by the Nevada Council to Establish Academic Standards for Public Schools, define science standards as what students know or are able to do in science at particular times in their educational careers. Please answer the questionnaire that will be used to measure the impact of Nevada Science Standards. All responses will remain confidential and anonymous. Once finished, please place questionnaire in provided envelope and return to your school's principal by April 30, 2001.

Part I: Please circle the number that most accurately describes your professional and personal background.

A. Gender:
   1. Male  
   2. Female

B. Highest Level of Education:
   1. Bachelors  
   2. Masters  
   3. Masters +

C. Number of College Science Courses Completed.
   1. 1 – 3
   2. 4 – 6
   3. 7 – 9
   4. 10 – 12
   5. 13 +

D. Your School's Current Enrollment:
   1. 900 or less  
   2. 901 – 1999  
   3. 2000 or greater

E. Total Years Teaching Experience: _______

173
Part II: Please answer the following questions as they currently apply to your school by circling the appropriate number. All answers have five possible responses based on a scale of 1 - 5. The scale is as follows:

Disagree = 1  Somewhat Disagree = 2  Neutral = 3  Somewhat Agree = 4  Agree = 5

At my school, I believe Nevada Science Standards...

1. have established common expectations to guide curriculum development.  
2. assist in holding students accountable for developing certain knowledge and skills.  
3. assist administrators in holding teachers accountable for student learning.  
4. assist administrators in holding teachers accountable for instructional improvement.  
5. assist teachers in holding administrators accountable for student learning.  
6. assist teachers in holding administrators accountable for instructional improvement.  
7. assist administrators in holding parents accountable for student learning.  
8. assist teachers in holding parents accountable for student learning.  
9. assist students in holding themselves accountable for their own learning.  
10. are used to design student assessment programs in science classes.  
11. are used to assist teacher supervision in science classrooms.  
12. are discussed during teacher evaluation conferences.
Disagree = 1  Somewhat Disagree = 2  Neutral = 3  Somewhat Agree = 4  Agree = 5

At my school, I believe Nevada Science Standards...

13. are used to design science professional development programs.
   1 2 3 4 5

14. match our goals for what we want and expect from science curricula.
   1 2 3 4 5

15. guide our goals for what we want and expect from science curricula.
   1 2 3 4 5

16. help improve academic achievement of students.
   1 2 3 4 5

17. help teachers develop interdisciplinary (integrated) approaches to content areas.
   1 2 3 4 5

18. are understood by science teachers.
   1 2 3 4 5

19. are understood by administrators.
   1 2 3 4 5

20. are a priority.
   1 2 3 4 5

21. encourage science teachers to promote professional dialogue among themselves.
   1 2 3 4 5

22. have positively impacted science instruction.
   1 2 3 4 5

23. have been implemented into our science curricula.
   1 2 3 4 5

24. are used to supervise teacher performance.
   1 2 3 4 5

25. guide lesson development.
   1 2 3 4 5

26. have had a positive impact on classroom supervision.
   1 2 3 4 5

27. have had a positive impact on science instruction.
   1 2 3 4 5

28. have improved the pre-existing science curricula.
   1 2 3 4 5

29. allow science teachers to emphasize teaching and learning.
   1 2 3 4 5

30. are aligned with the current science curricula.
   1 2 3 4 5

31. promote group development among science teachers.
   1 2 3 4 5

32. assist students in learning science.
   1 2 3 4 5
Disagree = 1 Somewhat Disagree = 2 Neutral = 3 Somewhat Agree = 4 Agree = 5

At my school, I believe Nevada Science Standards...

33. provide common academic expectations for all students. 1 2 3 4 5
34. reflect our expectations for student achievement. 1 2 3 4 5

For this portion of the questionnaire, the term administrator(s) refers to the individual principal, assistant principal, or dean who directly supervises science classrooms and science teachers.

Disagree = 1 Somewhat Disagree = 2 Neutral = 3 Somewhat Agree = 4 Agree = 5

At my school, the administrator(s)...

35. works collaboratively with science teachers implementing Nevada science standards. 1 2 3 4 5
36. encourages teachers' reflective behavior (i.e. Planning more carefully, responding to student diversity). 1 2 3 4 5
37. supports collaborative efforts among all science educators. 1 2 3 4 5
38. promotes professional dialogue among science teachers. 1 2 3 4 5
39. promotes professional growth among teachers (i.e., workshops, training, etc). 1 2 3 4 5
40. talks to teachers to promote reflection. 1 2 3 4 5
41. invites science teachers to talk openly and frequently about science instruction. 1 2 3 4 5
42. emphasizes teaching and learning in the science classroom. 1 2 3 4 5
43. encourages science teachers to take risks. 1 2 3 4 5
44. dialogues openly and frequently with science teachers about science instruction. 1 2 3 4 5
45. makes suggestions about science lessons. 1 2 3 4 5
46. provides opportunities for peer connections among teachers. 1 2 3 4 5
Disagree = 1  Somewhat Disagree = 2  Neutral = 3  Somewhat Agree = 4  Agree = 5

At my school, the administrator(s)...

47. provides feedback about science instruction.  
   1  2  3  4  5

48. solicits teachers' advice and opinions about classroom science instruction.  
   1  2  3  4  5

49. supports science teachers' efforts for classroom innovation.  
   1  2  3  4  5

Would you like a copy of the results?  ____ Yes  ____ No

If you are willing to participate in a telephone interview, please provide the following information. All responses will be kept confidential.

First Name: _________________________________________________

Phone Number(s): (H):_________________ (W):__________________

Best Time to Call: (H):_________________ (W):___________________

In the provided envelope, return the questionnaire to your school's principal. Thank you.

Science Teacher Form # ________
## APPENDIX III

### QUESTION MATRIX

<table>
<thead>
<tr>
<th>Questionnaire Question</th>
<th>Research Question Item #</th>
</tr>
</thead>
<tbody>
<tr>
<td>At my school, I believe Nevada science standards...</td>
<td></td>
</tr>
<tr>
<td>help teachers develop interdisciplinary (integrated) approaches to content areas.</td>
<td># 1a 17</td>
</tr>
<tr>
<td>have positively impacted science instruction.</td>
<td># 1a 22</td>
</tr>
<tr>
<td>guide lesson plan development.</td>
<td># 1a 25</td>
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<tr>
<td>have had a positive impact on science instruction.</td>
<td># 1a 27</td>
</tr>
<tr>
<td>allow science teachers to emphasize teaching and learning.</td>
<td># 1a 29</td>
</tr>
<tr>
<td>provides common academic expectations for all students.</td>
<td># 1a 33</td>
</tr>
<tr>
<td>are used to design student assessment programs in science classes.</td>
<td># 1b 10</td>
</tr>
<tr>
<td>help improve academic achievement of students.</td>
<td># 1b 16</td>
</tr>
<tr>
<td>assist students in learning science.</td>
<td># 1b 32</td>
</tr>
<tr>
<td>reflect our expectations for student achievement</td>
<td># 1b 34</td>
</tr>
<tr>
<td>assist in holding students accountable for developing certain knowledge and skills.</td>
<td># 1c 2</td>
</tr>
<tr>
<td>assist administrators in holding teachers accountable for student learning.</td>
<td># 1c 3</td>
</tr>
<tr>
<td>assist administrators in holding teachers accountable for instructional improvement.</td>
<td># 1c 4</td>
</tr>
<tr>
<td>assist teachers in holding administrators accountable for student learning.</td>
<td># 1c 5</td>
</tr>
<tr>
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<td>Code</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>assist teachers in holding administrators accountable for instructional improvement.</td>
<td>#1c</td>
</tr>
<tr>
<td>assist administrators in holding parents accountable for student learning.</td>
<td>#1c</td>
</tr>
<tr>
<td>assist teachers in holding parents accountable for student learning.</td>
<td>#1c</td>
</tr>
<tr>
<td>assist students in holding themselves accountable for their own learning.</td>
<td>#1c</td>
</tr>
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<td>are used to design science professional development programs.</td>
<td>#1d</td>
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<td>are understood by science teachers.</td>
<td>#1d</td>
</tr>
<tr>
<td>are understood by administrators.</td>
<td>#1d</td>
</tr>
<tr>
<td>encourages science teachers to promote professional dialogue among themselves.</td>
<td>#1d</td>
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<tr>
<td>promote group development among science teachers.</td>
<td>#1d</td>
</tr>
<tr>
<td>have established common expectations to guide curriculum development.</td>
<td>#1e</td>
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<tr>
<td>match our goals for what we want and expect from science curricula.</td>
<td>#1e</td>
</tr>
<tr>
<td>guide our goals for what we want and expect from science curricula.</td>
<td>#1e</td>
</tr>
<tr>
<td>are a priority.</td>
<td>#1e</td>
</tr>
<tr>
<td>have been implemented into our science curricula.</td>
<td>#1e</td>
</tr>
<tr>
<td>have improved the pre-existing science curricula.</td>
<td>#1e</td>
</tr>
<tr>
<td>are aligned with current science curriculum.</td>
<td>#1e</td>
</tr>
<tr>
<td>are used to assist teacher supervision in science classrooms.</td>
<td>#1f</td>
</tr>
<tr>
<td>are discussed during teacher evaluation conferences.</td>
<td>#1f</td>
</tr>
</tbody>
</table>
are used to supervise teacher performance.  

have had a positive impact on classroom supervision.  

and science teachers work collaboratively implementing Nevada science standards.  

enhances teachers' reflective behavior (i.e. Planning more carefully, responding to student diversity).  

supports collaboration efforts among all science educators.  

promotes professional dialogue among science teachers.  

promotes professional growth among teachers.  

talks to teachers to promote reflection.  

invites science teachers to talk openly and frequently with administrators about science instruction.  

emphasizes teaching and learning in the science classroom.  

encourages science teachers to take risks.  

dialogues openly and frequently with science teachers about science instruction.  

makes suggestions about science lessons.  

provides opportunities for peer connections among teachers.  

provides feedback about science instruction.  

solicits teachers' advice and opinions about classroom science instruction.  

supports science teachers' efforts for classroom innovation.
April 10, 2001

[Name of Principal]
[Name of School]
[Address of School]
[City, State, Zip Code]

Dear [Name of Principal],

I am a doctoral candidate at the University of Nevada, Las Vegas within the Department of Educational Leadership. I am respectfully requesting your participation in a research project that focuses on principals' and science teachers' perceptions of standards-based reform efforts and the role of instructional leadership.

Within the next few days, you will be sent a packet that includes instructions, two blue administrator questionnaires with envelopes, twenty white science teacher questionnaires with envelopes, and a stamped, self-addressed return envelope. The Nevada Science Standards Questionnaire should take no longer than 12 minutes for an individual to complete. The data collected during this study will illustrate the current status of standards-based reform in Nevada's science classrooms as well as describing instructional leadership’s role in standards-based reform.

All documentation associated with this study will be stored and secured at the University of Nevada, Las Vegas for three years. In addition, assurances are given that responses will be held in strictest confidence. If you have any questions, please call 702-798-2960. If you would like a summary of the results, please indicate on questionnaire.

Thank you for your cooperation and assistance.

Sincerely,

Robert B. Anderson
Doctoral Candidate
University of Nevada, Las Vegas
APPENDIX V

INTERVIEW PROTOCOLS

Nevada Science Standards
Interview Questions: Administrator

INSTRUCTION:

1. Describe how Nevada science standards have influenced classroom instruction in the classrooms you supervised?
   Probes:
   A. Are science teacher's lesson plans benchmarked to Nevada science standards? Why is this (or is not) important?
   B. How have Nevada science standards changed the science curriculum at your school?

ASSESSMENT:

2. How have Nevada science standards changed student assessment techniques in the science classrooms you supervise?
   Probes:
   A. What types of assessment are used?
   B. Since Nevada science standards were implemented in 1998, have you observed any change in student achievement?

ACCOUNTABILITY:

3. Some people would say that standards promote greater accountability. How would you respond to that comment?
   Probes:
   A. Do Nevada science standards promote greater accountability for instructional improvement?
   B. What have you done to ensure that Nevada science standards are implemented in classrooms that you supervise?
   C. Do Nevada science standards provide common expectations about student achievement?
   D. How have Nevada science standards assisted in holding the following accountable for student learning: (a) parents, (b) students, and (c) science teachers?
E. How have Nevada science standards assisted in holding science teachers accountable for instructional improvement?

PROFESSIONAL DEVELOPMENT:

4. Some people would say Nevada science standards promote professional development. How would you respond to this comment?
Probes:
   A. What is your school doing currently to promote science standards?
   B. How have you personally been activate in science standards implementation at your school?
   C. How are (were) standards implemented at your school?
   D. How important are Nevada science standards to your school?
   E. What can administrators do to assist teachers in implementing science standards?

CURRICULUM:

5. Describe how Nevada science standards have changed your school's science curricula?
Probes:
   A. Discuss how your school's science curriculum is aligned with the state curriculum?
   B. In your opinion, do standards match your school's goals about science education?

SUPERVISION:

6. Describe how supervision has been impacted by Nevada science standards?
Probe:
   A. Are Nevada science standards discussed during teacher evaluation conferences?
   B. During classroom observations, are Nevada science standards used as a guideline to supervise teacher performance?

SCHOOL SIZE:

7. In your opinion, what is the ideal size of a secondary high school?
Probe:
   A. What benefits are afforded children who attend large schools?
   B. What benefits are afforded children who attend small schools?
   C. How has the size of your school affected Nevada science standards implementation?
D. What advantages or disadvantages does your school size provide students?
E. Would you describe your school as small, medium, or large?
F. How does the size of your school affect the amount of time devoted to instructional improvement?

GENERAL QUESTIONS:

1. What is your opinion of Nevada science standards?
2. Are standards going to sustain systematic change to Nevada's school system? Why or why not?
3. How were Nevada science standards developed? Did you have an opportunity to collaborate in their development?
4. Describe your school's commitment to Nevada science standards?
Nevada Science Standards

Interview Questions: Science Teachers

INSTRUCTION:

1. Describe how Nevada science standards have influenced your classroom instruction?
   Probes:
   A. Are your lesson plans benchmarked to the Nevada science standards?
   B. How have Nevada science standards influence your instruction?
   C. How have Nevada science standards changed the science curriculum at your school?

ASSESSMENT:

2. How have Nevada science standards changed student assessment techniques in your classroom?
   Probes:
   A. What types of assessment do you use?
   B. Since Nevada science standards were implemented in 1998, have you observed any change in student achievement?

ACCOUNTABILITY:

3. Some people would say that standards promote greater accountability. How would you respond to that comment?
   Probes:
   A. Do Nevada science standards promote greater accountability your instruction?
   B. What have you done to ensure that Nevada science standards are implemented in your classrooms?
   C. Do Nevada science standards provide common expectations about student achievement?
   D. How have Nevada science standards assisted in holding the following accountable for student learning: (a) parents, (b) students, and (c) administrators?
   E. How have Nevada science standards assisted in holding administrators accountable for instructional improvement?
PROFESSIONAL DEVELOPMENT:

4. Some people would say Nevada science standards promote professional development. How would you respond to this comment?
   - Probes:
     A. What is your school doing currently to promote science standards?
     B. How have you personally been active in science standards implementation at your school?
     C. How are (were) standards implemented at your school?
     D. How important are Nevada science standards to your school?
     E. How has your principal or supervising principal facilitated standard?

CURRICULUM:

5. Describe how Nevada science standards have changed your school's science curricula?
   - Probes:
     A. Do you design assessment around science standards. If so, what type of assessment do you use?
     B. Discuss how your school's science curriculum is aligned with the state curriculum? In your opinion, do standards match your school's goals about science education?

SUPERVISION:

6. Describe how classroom supervision has been impacted by Nevada science standards?
   - Probes:
     A. Are Nevada science standards discussed during your teacher evaluation conferences?
     B. During classroom observations, are Nevada science standards used as a guideline to supervise your performance?

SCHOOL SIZE:

7. In your opinion, what is the ideal size of a high school?
   - Probes:
     A. What benefits are afforded children who attend large schools? What benefits are afforded children who attend small schools?
     B. How has the size of your school affected Nevada science standards implementation?
     C. What advantages or disadvantages does your school size provide students?
     D. Would you describe your school as small, medium, or large?
     E. How does student enrollment affect science standard implementation?
GENERAL QUESTIONS:

1. What is your opinion of Nevada science standards?
2. Are standards going to sustain systematic change to Nevada's school system? Why or why not?
3. How were Nevada science standards developed? Did you have an opportunity to collaborate in their development?
4. Describe your school's commitment to Nevada science standards?
### APPENDIX VI

#### T-TESTS AND ANOVA

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Research Question Three

Questionnaire Analysis of Variance Results: Science Teachers

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VITA

Graduate College
University of Nevada, Las Vegas

Robert Bruce Anderson

Address:
1000 American Pacific Drive #2322
Henderson, Nevada 89074

Degrees:
Bachelor of Science, Biology, 1993
State University of New York, College at Fredonia

Master of Education, Educational Leadership, 1997
University of Nevada, Las Vegas

Dissertation Title: Perceptions of Standards-based Reform and the Role of Instructional Leadership

Dissertation Examination Committee:
Chairperson, Dr. Patti L. Chance, Ph. D.
Committee Member, Dr. Carl Steinhoff, Ed. D.
Committee Member, Dr. James Crawford, Ph. D.
Graduate Faculty Representative, Dr. Porter Troutman, Ed. D.