

A PHENOMENOLOGICAL STUDY OF HIGH SCHOOL BIOLOGY TEACHERS'
PERCEPTIONS OF THE NORTH CAROLINA PROFESSIONAL TEACHING
STANDARDS IN AN ERA OF HIGH-STAKES TESTING

A Dissertation
by
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ABSTRACT

A PHENOMENOLOGICAL STUDY OF HIGH SCHOOL BIOLOGY TEACHERS' PERCEPTIONS OF THE NORTH CAROLINA PROFESSIONAL TEACHING STANDARDS IN AN ERA OF HIGH-STAKES TESTING (December 2011)

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This qualitative study investigated four career status, four initially licensed, and four lateral-entry high school Biology teachers' perceptions of the North Carolina Professional Teaching Standards' (NCPTS) usefulness in preparing them to be exemplary science teachers. These teachers are among the first group of teachers to use the NCPTS for professional growth and be evaluated with the Teachers Evaluation Process (TEP). Several historical documents including *National Science Education Standards*, *National Board for Professional Teaching Standards*, and *How People Learn*, along with NSTA's Search of Excellence in Science Teaching identify the characteristics of exemplary science teaching. These best practices are reflected in the NCPTS. Individual and cross case analysis found four themes of high-stakes testing, time, technology, and the Teacher Evaluation Process that have an impact on these teachers. The results indicated there is an inconsistent distribution of technological resources, lack of funding for lab equipment and supplies, lack of time for inquiry, and lack of time to find and use resources. Teachers feel the additional stress for unprepared and unmotivated

learners, a rigorous curriculum, and more accountability for student performance.

Implications of this research include: Administrators need to spend more time with initially licensed and lateral entry teachers to help them understand how to improve their practice.

There is a need for additional professional development for teachers to understand how to use the NCPTS to improve teaching and learning.

Keywords: teaching standards, science teaching, Biology teachers, accountability, high-stakes testing.

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Chapter 1

Introduction

The purpose of this research was to conduct a phenomenological study of four career status, four initially licensed, and four lateral-entry high school Biology teachers' perceptions of the North Carolina Professional Teaching Standards' (NCPTS) usefulness in preparing them to be exemplary science teachers in an era of high-stakes testing. These teachers are among the first group of teachers to use the NCPTS for professional growth and to be evaluated with the North Carolina Teachers Evaluation Process (TEP) that is based upon the NCPTS. The NCPTS are used by school administrators to evaluate teachers, and teacher educators who educate and evaluate pre-service teachers at the college level.

The NCPTS and TEP take their place along with the North Carolina Standard Courses of Study (SCOS), North Carolina End of Grade testing (EOG), and North Carolina End of Course testing (EOC), which have been used over the past two decades in an effort to improve student achievement. The EOCs were initiated in response to legislation passed by the North Carolina General Assembly in 1984 (North Carolina Department of Public Instruction Accountability Services Division, 2005), which are used to assess a student's knowledge of subject-related concepts from the SCOS. Accountability at the national level occurred with the passage of the No Child Left Behind Act (NCLB) of 2001 (No Child Left Behind Act, 2001). The NC Biology EOC test results are one of the five measures NC submits as required by the NCLB act.

This chapter introduces the study of how high school Biology teachers perceive and use the NCPTS. The NCPTS are another measure of accountability that NC has adopted as a way to improve public education in grades K-12. The NCPTS are described along with the problem statement, research questions, overview of methodology, and significance of the study and definition of key terms. This is the first known study to investigate how NC Biology teachers are utilizing the NCPTS to guide their practice. This study seeks to understand how these teachers are using the standards to improve teaching and learning. School reform theorists identify a need to understand how teachers think and learn (Pedretti, Bencze, Hewitt, Perris, & Van Oostveen, 2006).

The NCLB Act requires states to provide highly qualified teachers for their students. Fulfilling this requirement is difficult in rural school districts because science teachers are often required to teach more than one field of science (U.S. Department of Education, 2004a). This has stimulated recruitment efforts in North Carolina as well as other states where low-income and non-white students have experienced a revolving door of inexperienced and uncertified teachers (Darling-Hammond, 2007; McLaughlin, 2004;). Darling-Hammond reports recent studies have found that “teacher quality is a critical influence on student achievement and teachers are the most inequitably distributed school resource” (Darling-Hammond, 2007, p. 1). A teacher retention study by Glennie and Edmunds (2006) used North Carolina data to report minority, disadvantaged, and academically struggling students are more likely to be in hard to staff schools with fewer fully certified, experienced, and effective teachers. The NCPTS identify what teachers need to do to be successful, which may reduce the teacher attrition rate.

The mission of the North Carolina Professional Teaching Standards is “to ensure every student in North Carolina will have a knowledgeable, skilled, compassionate teacher” (North Carolina Professional Teaching Standards Commission, 2008d, p. 1). The NCPTS are the basis for teacher preparation, teacher evaluation, and professional development (North Carolina Professional Teaching Standards Commission, 2006). Each of the NCPTS includes the skills and knowledge needed for 21st Century teaching and learning (North Carolina Professional Teaching Standards Commission, 2006).

North Carolina Accountability

The North Carolina Elementary and Secondary Reform Act of 1984, and School-Based Management and Accountability Program of 1996 (North Carolina Department of Public Instruction Curriculum and School Reform Services, 2004) moved North Carolina to the forefront of high-states testing and accountability. The first End-of-Course tests (EOCs) began with Biology and Algebra 1, in 1987. In June 1996, the North Carolina State Board of Education developed the “ABCs of Public Education” in response to the School-Based Management and Accountability Program (ABCs) enacted by the North Carolina General Assembly (North Carolina Department of Public Instruction Accountability Services Division, 2008c).

The results of student achievement for state mandated accountability testing is provided to the public via NC School Report Cards. The NC School Report Card is designed to provide comprehensive information about all of North Carolina’s pre-K-12 grade public schools and public charter schools. This information includes: student achievement, class size, school safety and environment, teacher quality and demographic details about districts

and schools (Education First NC School Report Cards, 2009). The NC School Report Card is used by superintendents to improve schools, principals to improve teaching; and teachers to improve student performance. It is also used to identify professional development needs of individual teachers and faculties.

North Carolina End of Course Exams (EOC)

North Carolina Biology teachers are required to follow a Biology Standard Course of Study (SCOS) and their students are required to take a Biology EOC test. All North Carolina high school students, including students with disabilities who are enrolled in Algebra 1, Algebra 2, Biology, English 1, and Physical Science, must be administered and EOC for each course, with or without accommodations, or its alternate assessment. The EOC test score is counted as 25% of the final course grade (North Carolina Department of Public Instruction Accountability Services Division, 2007; North Carolina State Board of Education, 2004). North Carolina EOC tests are intended to provide an accurate measurement of students' knowledge and skills specified in the *Standard Course of Study*. The *Standard Course of Study* and *Support Documents* are the links between assessment and accountability. The EOC tests attempt to provide an accurate measurement of the knowledge and skills attained by groups of students for the school, school system, and state. When properly administered and interpreted, these results provide a uniform source of reliable and valid information, which enables:

- Students to know they have mastered the expected knowledge and skills, and how they compare to others.
- Parents to know if their children are acquiring the knowledge and skills needed to

succeed in a highly competitive job market.

- Teachers to know if their students have mastered grade-level knowledge and skills in the curriculum and, if not, what weaknesses need to be addressed.
- Community leaders and lawmakers to know if students in North Carolina schools are improving their performance over time and how the students compare with students around the state.
- Citizens to assess their return on investment in the public schools (North Carolina State Board of Education, 2004, p. 1).

The EOCs are used to compute the high school growth and performance composites required by the state-mandated accountability program and monitor adequate yearly progress (AYP) for the *No Child Left Behind Act of 2001* (NCLB). North Carolina submits the EOC data for Algebra I, Biology, Civics and Economics, English 1, and U.S. History for its measure for NCLB. Additionally, North Carolina students who entered the 9th grade for the first time in 2006-2007 and beyond are now required to score an Achievement Level 3 (with one standard error of measurement) on these five EOCs to be eligible for high school graduation (North Carolina Department of Public Instruction Accountability Services Division, 2008c).

Historically, the Biology EOC multiple-choice test results have been one of the lowest percent proficient in the ten high school courses tested with an EOC (North Carolina Department of Public Instruction Accountability Services Division, 2008c). The Biology EOC test results have one of the largest achievement gaps between white and nonwhite students; in 2007-2008 it was 79.6% for whites, and 47.8% for nonwhites (Haynie, 2006),

and 77.1% for advantaged and 52.5% for economically disadvantaged (North Carolina Department of Public Instruction Accountability Services Division, 2008a). These figures along with the shortage of certified science teachers illustrate the need for professional teaching standards to help initially licensed, lateral entry, and career status teachers meet the educational needs of diverse learners.

North Carolina Professional Teaching Standards

Prior to the NCPTS, North Carolina belonged to a consortium of state education agencies and national organizations known as the Interstate New Teacher Assessment and Support Consortium (INTASC) dedicated to the reform of the preparation, licensing, and on-going professional development of teachers. The basic premise of INTASC is “an effective teacher must be able to integrate content knowledge with specific strengths and needs of students to assure that all students learn and perform at high levels” (Council of Chief State School Officers, 2009, p.1). In an effort to improve teaching and learning in NC, the North Carolina Legislature mandated the creation of the NCPTS Commission and directed the commission to develop and recommend professional teaching standards to the State Board of Education. The North Carolina Article 20 of the General Statutes, Chapter 115C, 295.2 as amended reads in part: “The purpose of the NC Teaching Standards Commission is to establish high standards for North Carolina teachers and the teacher profession” (North Carolina Professional Teaching Standards Commission, 2009c, p. 1). The Legislative mandate for the North Carolina Teaching Standards includes:

- Develop and recommend to the State Board of Education professional standards for North Carolina teachers.

- Review the areas of teacher certification and recommend to the State Board of Education those areas that should be consolidated, redesigned, eliminated or enhanced.
- Consider current methods to assess teachers and teaching candidates, including the National Teacher Exam, the assessments of the National Board for Professional Teaching Standards, and alternative methods of assessment and recommend to the State Board of Education the implementation of rigorous and appropriate assessments for initial and continuing certification, which are valid and reliable measures of professional practice.
- Evaluate, develop and recommend to the State Board a procedure for the assessment and recommendation of candidates for initial and continuing teacher certification (North Carolina Professional Teaching Standards Commission, 2009b).

The North Carolina State Board of Education (SBOE) also mandated that the NCPTS Commission include the board's guiding mission statement that "every public school student will graduate from high school, globally competitive for work and post-secondary education, and prepared for life in the 21st Century" (North Carolina Professional Teaching Standards Commission, 2006, p. 1). This statement and the results of the North Carolina's Teacher Working Conditions Survey Initiative challenged the commission to produce something more than INTASC to evaluate the state's teachers. The demands of a 21st century education include new roles for teachers in their classrooms and schools. What teachers need to know and do to be able to teach students in the 21st Century includes:

- Leadership among the staff and with the administration is shared in order to bring consensus and common, shared ownership of the vision and purpose of work of the school. Teachers are valued for the contributions they make in their classrooms and schools.
- Teachers make the content they teach engaging, relevant, and meaningful to students' lives.
- Teachers can no longer cover material; they along with their students uncover solutions. They teach existing core content that is revised to include skills like critical thinking, problem solving, and information and communication's technology literacy.
- In their classrooms, teachers facilitate instruction encouraging all students to use 21st century skills, so they discover how to learn, innovate, collaborate, and communicate their ideas.
- The 21st century content (global awareness, civic literacy, financial literacy, and health awareness) is included in the core content areas.
- Subjects and related projects are integrated among disciplines and involve relationships with the home and community.
- Teachers are reflective about their practice and include assessments that are authentic and structured and demonstrate student understanding.
- Teachers demonstrate the value of lifelong learning and encourage their students to learn and grow (North Carolina Professional Teaching Standards Commission, 2008a).

In developing the NCPTS, the Commission incorporated the North Carolina Teacher Working Conditions Initiative (2009) survey results. The survey has been administered for the past five years, and over 104,000 (87%) of educators completed the fourth survey in 2008. The SBOE 21st Century goals, survey information, and a large number of National Board Certified Teachers were instrumental in the development of the new NCPTS. Data from the survey identified what's important for high student achievement. Administrators and teachers can use the survey results to improve teaching and learning in North Carolina. The survey results of the 2009 North Carolina Teacher Working Conditions Initiative include the following:

- supportive school leadership,
- sufficient facilities and resources,
- time for teachers to plan and collaborate,
- time for teachers to focus on students without interruption and additional duties,
- an atmosphere of trust and mutual respect,
- strong school improvement team and what's important to retain teachers,
- overall perception of the school being a good place to work and learn,
- and effective school improvement team (North Carolina Teacher Working Conditions Initiative, 2009).

While NC is striving to improve teaching and learning with the implementation of the NCPTS and data from the working conditions survey, the state is faced with a shortage of qualified teachers. This has forced many North Carolina school systems to utilize unqualified individuals, which leads to lower school performance and higher teacher attrition

(McLaughlin, 2004). Special education, mathematics, and science are typically found to have the highest turnover (Ingersoll, 2002). Ingersoll reported the following reasons teachers gave for their dissatisfaction, which includes: low salary, lack of administrative support, student disciplinary problems, little faculty influence, poor student motivation, unsafe environment, inadequate time, large class size, intrusions on teaching, no opportunity for advancement, and lack of community support. The North Carolina Teacher Working Condition Survey yields similar results (North Carolina Teacher Working Conditions Initiative, 2009). Teachers in North Carolina need administrative support, resources, no intrusions on teaching, opportunities to demonstrate leadership, trust and respect, and a school leadership team that meets the needs of students, parents, teachers, administration, and community.

The NC Legislative mandate for the creation of high teaching standards, the NC State Board of Education mandate for every student to be globally competitive and prepared for life in the 21st century, and the NC Teacher Working Conditions Survey were the guiding forces the NC Professional Teaching Standards Commission used to establish the following Standards for NC Teachers, these standards include:

- Standard 1: Teachers demonstrate leadership.
- Standard 2: Teachers establish a respectful environment for a diverse population of students.
- Standard 3: Teachers know the content they teach.
- Standard 4: Teachers facilitate learning for their students.
- Standard 5: Teachers reflect on their practice.

The first NC Professional Teaching Standard encourages teachers to demonstrate leadership within the classroom and school. Teachers have opportunities to develop these skills through the school improvement team, which assists in determining school budget,

professional development plans, and contributing to the establishment of positive working conditions. The second NC Professional Teaching Standard outlines the need for teachers to work collaboratively with the families and significant adults in the lives of their students. The third NC Professional Teaching Standard requires teachers to align their instruction with the NC SCOS, know the content appropriate to their teaching specialty, recognize the interconnectedness of other content areas, and make instruction relevant to students. The fourth NC Professional Teaching Standard identifies the need for teachers to facilitate learning for their students, which includes understanding ways in which learning takes place and the appropriate levels of intellectual, physical, social, and emotional development. Teachers are asked to use a variety of data sources for short and long range planning based on the SCOS. The standard also encourages teachers to collaborate with colleagues, and monitor and modify plans to enhance student learning. Teachers need to include a variety of instructional methods, integrate and utilize technology, help students develop critical thinking and problem solving, and help students work in teams. This standard also includes the use of formative and summative assessments, which are more than common assessments and district benchmarks. Teachers need to understand this metacognitive technique for students if they are going to have the desired effect of improved student achievement. Finally, Standard five encourages teachers to reflect upon their practice. This includes thinking systematically and critically about learning in their classroom, and analyzing student performance data to improve instruction. This will require teachers to consider new ways of teaching and learning based on research and data (North Carolina Professional Teaching Standards Commission, 2009a).

The NCPTS addresses the problems in NC public schools and encourages teachers to be part of the solution. Will the implementation of the NCPTS have the desired effect, will teachers feel empowered to become a leader, master their content, include rigorous expectations for students, provide opportunities for 21st century learning, integrate across the curriculum, be reflective about their practice and assessments, and demonstrate lifelong learning? Will teachers use the NCPTS to achieve these goals or will they be another factor prompting to leave the teaching profession? Will the NCPTS move education in NC forward and serve as a model for other states to improve educations? Now that the NCPTS are in place and teachers are being evaluated, what are the limitations and issues which may prevent this vision becoming a reality? This study seeks to understand how Biology teachers perceive the usefulness of these Standards to improve their practice, while at the same time teaching in a high-stakes testing environment of state and federal accountability.

Problem Statement

The report of the National Commission Teaching and America's Future (1996) identifies three essential tenets for improving public education. These tenets include: what teachers know and can do is the most important influence on what students learn, recruiting, preparing, and retaining good teachers, and the need for supportive working conditions. The Report (1996) contends “American students are entitled to teachers who know their subjects, understand their students and what they need, and have developed the skills required to make learning come alive” (National Commission on Teaching and America's Future, 1996, p.10). The Commission identified barriers to achieving this goal, which includes: low expectations for student performance, unenforced standards for teachers, inadequate induction for

beginning teachers, and lack of professional development and rewards for knowledge and skill.

One of the major recommendations to address these concerns and accomplish the goal of providing for America's future is the establishment of professional teaching standards in every state and the use of the National Board Teaching Standards as the benchmark for accomplished teaching (Carroll & Foster, 2010; National Commission on Teaching and America's Future, 1996). According to the National Commission, "there has been no previous time in history when the success and survival of nations and people depend on their ability to teach students in ways that help them reach high levels of intellectual and social competence" (National Commission on Teaching and America's Future, 1996, p. 3).

The North Carolina Professional Teaching Standards Commission provides rigorous teaching standards that address the challenges identified in the National Commission's report. However, North Carolina faces a chronic and growing shortage of public school teachers due to the state's rapidly increasing school-age population, efforts to reduce class size, and a 20% or more annual teacher turnover rate in some districts (McLaughlin, 2004). The state hires about 10,000 teachers each year; however the public and private colleges and universities in NC produce 2,200 certified teachers and only 1,400 will likely be teaching three years later (McLaughlin, 2004).

School districts are increasing the hiring of out-of-state teachers and teachers who enter the profession through lateral entry. The state will hire more than half of the teachers who will be teaching within the next decade. With high-stakes testing and replacing a vast number of teachers, there is a sense of urgency for the implementation of the NCPTS. The

philosophy of the NCPTS states “the quality of teachers is the single most important factor in achieving quality of schools, and no innovation or effective school reform can take place if teachers are not equipped, prepared, and eager to implement change” (North Carolina Professional Teaching Standards Commission, 2009c, p. 1).

Over the past two decades, the National Commission on Teaching and America’s Future and the National Board for Professional Teaching Standards Commission have worked to establish appropriate teaching standards. Former NC Governor James B. Hunt served as chair for both commissions, and he has been instrumental in the development of the North Carolina Professional Teaching Standards. Although NC has the highest number of National Board Certified Teachers (National Board for Professional Teaching Standards, 2010a), limited numbers of NC teachers are eligible to apply and only a few hundred teachers in NC achieve certification each year. Beginning with the 2010-2011 school year, all NC teachers will be evaluated with the NCPTS regardless of teacher preparation and years of experience. North Carolina is the first state to attempt to improve public education with professional teaching standards linked to student achievement (R. Garland, personal communication, August 24, 2010). The implementation of the NCPTS began in 2008-2009 with 13 school districts designated as Phase 1. The following year another 39 school districts were added, and the remaining school districts were added for the 2010-2011 school year (North Carolina Professional Teaching Standards Commission, 2008a).

This study investigated how high school Biology teachers in the Phase 1 and 2 school districts are using the NCPTS. This study will also investigate their perceptions of the usefulness of these standards for professional growth. These teachers have the most

experience with using the NCPTS, and the NC Teacher Evaluation Process. The intended purpose of the NC Teacher Evaluation Process instrument is “to assess performance in relation to the standards and to serve as a development model for individual growth and development for the practitioner” (North Carolina Department of Public Instruction Professional Development, 2008, p. 1). The NCPTS Commission believes all of our schools must be communities of highly accomplished professionals. They believe the standards for teaching will continue to evolve and these Standards must be constantly examined and revised (North Carolina Professional Teaching Standards Commission, 2009a). The NCPTS Commission believes the NCPTS go hand in hand with improving the salaries and working conditions for teachers to have the greatest impact on education of North Carolina’s children (North Carolina Professional Teaching Standards Commission, 2009c).

Research Questions

The primary research question is: What are high school Biology teachers’ perceptions of the NCPTS as a tool to improve their teaching and student learning in a high-stakes testing environment? The secondary questions include:

1. How do Biology teachers perceive the need to improve teaching and learning?
2. How do Biology teachers use the NCPTS to guide teaching and learning?
3. Which leadership opportunities are Biology teachers aware of and involved with?
4. How do Biology teachers establish a respectful environment for a diverse population?
5. Which curriculum and instruction resources are available and being used?
6. How do Biology teachers make instruction relevant for students?

7. How are Biology teachers assessing student learning?
8. How do Biology teachers use the NCPTS to guide their professional development?
9. How and what resources do Biology teachers use to reflect upon their practice?

Overview of Methodology

This is a phenomenological study of 12 NC high school Biology teachers' perceptions of the NCPTS. Eight participants were selected from the school systems designated as Phase 1, which began using the standards for the 2008-2009 school year, and four participants from Phase 2, which began using the standards for the 2009-2010 school year. These teachers have the most experience using and being evaluated with the NCPTS. Participants for this study included four career status high school Biology teachers, four initially licensed high school Biology teachers, and four lateral entry high school Biology teachers. Participants were selected from volunteers who responded to an email request for participants to share their perceptions of the NCPTS. No other criteria were used to select participants; selection was not based on the gender, race, or ethnic background.

Phenomenological research has been described as an investigation of the variation in human understanding, conceptions, awareness, meanings, or ways of experiencing a particular phenomenon (Akerlind, 2005). It includes the structural relationships linking these different ways of experiencing the phenomenon which can then be used to understand the relationships between experiencing the one phenomenon. Phenomenological research provides a way of looking at collective human experience of phenomena holistically. Interviews consists of open-ended questions which are used to probe in-depth responses about these teachers' experiences, perceptions, opinions, feelings, and knowledge of a shared

phenomenon (Patton, 2002). The phenomenon in this research is the experience of being the first group of teachers to be evaluated with the North Carolina Professional Teaching Standards.

Individual interviews were conducted for 60 to 90 minutes to provide participants an opportunity to speak from personal experiences. According to Lincoln and Guba (1985) these teachers construct their social reality based upon their frame of reference in the school. These realities often overlap one another, because they are dealing with the same commonly believed phenomenon (Lincoln & Guba, 1985). Characteristics of a good qualitative study include: observations, immediate, validation of interpretations, and triangulation of data (Denzin, 1996; Maxwell, 2005). Triangulation of the data is used to increase the credibility and validity of the results. The triangulation of the data in this research includes: interviews and notes written during the interview, participant member checks, and opportunities for participants to make additional comments via email. A researcher's journal was used to help avoid personal bias of the interpretation of the data.

Significance of the Study

This study is significant because it seeks to understand NC high school Biology teachers' perceptions of how the North Carolina Professional Teaching Standards (NCPTS) are being used to improve teaching and learning in an era of high-stakes testing. The Biology EOC scores are a measure for state (North Carolina Department of Public Instruction, 2009a) and federal accountability (No Child Left Behind Act, 2001). Additionally, Biology students must attain an acceptable score on the Biology EOC for high school graduation. This is the

first known study to investigate the usefulness of the NCPTS to improve teaching and learning.

Teaching requires educators to investigate and consider new ideas that improve teaching and learning for every child. Investigating teachers' perceptions and experiences of how the NCPTS are being implemented in classrooms may provide suggestions for its success in bringing about the vision of citizens prepared for the workplace of the 21st century. This research provides an opportunity to gather information to determine if the NCPTS are a useful tool for high school Biology teachers to improve their practice.

Definition of Key Terms

1. *Accountability of the North Carolina Department of Public Education (ABC)*: The ABCs began with the 1996-97 school year as the primary school improvement program. The program has three primary goals: strengthen school accountability, emphasize mastery of basic subjects and provide as much local decision-making as possible. The ABC model is a school-level accountability system, which generates information that allows the state to target school improvement efforts. The ABCs model was also one of the first in the nation to focus attention on the academic growth of students from year-to-year (North Carolina Department of Public Instruction Accountability Services Division, 2008c).
2. *Annual Yearly Progress (AYP)*: Under No Child Left Behind, each state has developed and implemented measurements for determining whether its schools and local educational agencies (LEAs) are making adequate yearly progress (AYP). A state's measure of progress toward the goal of 100 percent of students achieving the

- state academic standards in reading/language arts and math is called AYP. This is the minimum level of proficiency that the state, its school districts, and schools must achieve each year on annual tests and related indicators. The parents/guardian of children who attend Title 1 (low-income) schools that do not make AYP over a period of years are given the option of transferring their child to another school or receive free tutoring of their child (U.S. Department of Education, 2009a).
3. *Career Status (tenure)*: Full-time employees must be employed under probationary contract in a position requiring licensure for four consecutive years in the same public school system to be eligible for recommendation of career status. Employees must also be on a continuing license track for career-status (North Carolina Department of Public Instruction, 2010a).
 4. *End-of-Course tests (EOC)*: These tests are based on the assessment of higher level skills within the subject specific content. The NC EOCs were developed to provide an accurate measurement of an individual student and groups of students' skills specified in the NC SCOS for school, school system, and state accountability (North Carolina Department of Public Instruction Accountability Services Division, 2007).
 5. *End-of-Grade tests (EOG)*: The tests for science in grades 5 and 8 requires students to demonstrate knowledge of important principles and concepts, understanding and interpret laboratory activities, and relate scientific information to everyday situations. Beginning in the spring of 2008 these tests are administered statewide (North Carolina Department of Public Instruction, 2004).

6. *Essential Standards*: The essential standards are the skills, understandings and learning experiences that a student must master at each grade level to move to the next grade level. They are the goals of the curriculum that help teachers focus on higher-order knowledge and skills that all students should master. They are intended to resolve the inch-deep and mile-wide North Carolina's current Standard Course of Study. They are written to ensure every student learns essential content and skills for the 21st century (North Carolina Department of Public Instruction Accountability Services Division, 2009c).
7. *Highly Qualified Teacher*: Is an NCLB defined teacher requirement which, in NC, is a teacher who has obtained full state teacher certification or has passed the state teaching licensing examination and holds a license to teach in the state; holds a minimum of a bachelor's degree; and has demonstrated subject area competence in each of the core-academic subjects in which the teacher teaches (North Carolina Department of Public Instruction, 2001).
8. *Lateral Entry*: An alternate route to teaching which allows qualified individuals to obtain a license as they teach. When school systems are unable to fill positions, they can initiate the process for hiring lateral entry candidates (North Carolina Department of Public Instruction Licensure Division, 2009). These individuals have a college degree but lack certification.
9. *National Board Certified Teacher (NBCT)*: NBCT are highly accomplished educators who meet high and rigorous standards (National Board for Professional Teaching Standards, 1987a).

10. *National Science Education Standards (NSES)*: The Standards present a vision of a scientifically literate population, and outline what students need to know, understand, and be able to do at different grade levels (Center for Science, Mathematics, and Engineering Education, 2009).
11. *No Child Left Behind Act (NCLB)*: The federal government created the NCLB Act, which uses state test scores to evaluate and allocate resources. The act requires improvement for the preparation, training, and recruitment of high quality teachers and principals, and improvement for the education of the disadvantaged students and the language instruction for limited English proficient and immigrant students (NCLB Act, 2001). It requires educators to have deeper content knowledge, a better understanding of subject matter standards, broader repertoires of teaching strategies, and diagnostic skills to meet the educational needs of diverse student populations (Darling-Hammond, 2000).
12. *Pre-service Teachers*: Student teachers prior to employment.
13. *Stakes*: This is defined as consequences for students and/or schools linked to testing results, and the pressure and informal consequences intended to induce staff to raise test scores (Corbett & Wilson, 1991).
14. *Standard Course of Study*: The framework that guides classroom instruction and assessment for every student in the state and provides competency goals for each high school course to ensure rigorous student academic performance standards that are uniform across the state (North Carolina Department of Public Instruction Accountability Services Division, 2004).

Organization of the Study

Chapter 1 provides an introduction and a rationale for this research study. It includes the pertinent information about the movement for accountability in education, the unique situation for North Carolina Biology teachers and students in the state and national accountability model, and the development of the NCPTS. Chapter 2 explains the history and importance of science education in America. It includes a review of the literature for the search for excellence in science teaching, National Science Education Standards, National Board for Professional Teaching Standards, and development of the NCPTS. This chapter also includes research on “How People Learn,” and recent reforms in education. Chapter 3 describes the methods used to conduct this phenomenological study. Chapter 4 includes an introduction of the participants and this study’s results. Chapter 5 presents the analysis with links to the literature and addresses the gaps and limitations in the study. It also includes a revision of the conceptual framework for the study, implications and further research.

Chapter 2

Literature Review

The focus of this study is on high school Biology teachers' perceptions of the North Carolina Professional Teaching Standards in an era of high-stakes testing. Teachers are expected to use these standards to plan and guide instruction using the skills and knowledge needed for 21st century teaching and learning. Teachers also use the NCPTS to guide their professional development as well as have their job performance based on these standards. Implementation of the standards has been occurring over a three year period beginning with pilot school systems in 2008-2009 and state-wide implementation by the school year 2010-2011.

This study seeks to understand how high school Biology teachers are using the NCPTS to improve their practice. The NCPTS for teaching includes: leadership, establishing a respectful environment for a diverse population of students, course specific content knowledge, facilitating learning for students and teachers reflecting upon their practice. This literature review explores the history of the movement to improve science education in the United States, development of *National Science Education Standards*, NSTA Search for Excellence in Science Teaching, the history and development of the National Professional Teaching Standards, characteristics of exemplary science teaching, *How People Learn*, high-stakes testing, and discrepancies between the envisioned and reported.

According to the research conducted by the National Commission on Teaching and America's future "the nation stands to lose half of its teachers to retirement over the next decade" (Carroll & Foster, 2009, p. 2). The teacher attrition rate has been identified as a central cause for the current shortage of teachers (Colley, 2002; Ingersoll, 2002; Luekens, Lyter, & Fox, 2004). A tremendous amount of human and financial capital is consumed by the constant process of hiring and replacing beginning teachers before they have mastered the ability to collaborate with colleagues to create solid learning opportunities for their students (Darling-Hammond, 1999). Carroll and Foster (2009) estimate as many as two thirds of the teachers in America could be gone within five years. The collective wisdom of veteran teachers cannot be easily replaced.

History of the Movement to Improve Science Education in the United States

The urgency to improve science education in the United States began over fifty years ago with the launching of Sputnik in 1957. Several publications, including: *A Nation at Risk* (National Commission on Excellence in Education, 1983), *Science for All Americans* (American Association for the Advancement of Science, 1989), *Benchmarks for Science Literacy* (American Association for the Advancement of Science/Project 2061, 1993), *Trends in International Mathematics and Science Study* (U.S. Department of Education, 2003), *National Science Education Standards* (NSES) (National Research Council, 1996), and *The Nation's Report Card* (U.S. Department of Education, 2005) indicate the U.S. is lagging behind other industrialized nations in mathematics and science achievement. The *Third International Mathematics and Science Study* (TIMSS) (International Association for the Evaluation of Educational Achievement, 2003) indicates U.S. students are not taught

what they need to know, and the high school curricula lacks coherence, depth, and continuity, and covers too many topics superficially.

The American Association for the Advancement of Science (AAAS) founded Project 2061 in 1985; its publication, *Science for All Americans*, includes what all students should be able to do in science, mathematics, and technology. *Science for All Americans* became the groundwork for the nationwide science standards movement of the 1990s and defines science literacy and principles for effective learning and teaching. *Science for All Americans* emphasizes the connections between the natural and social sciences, mathematics, and technology, and the knowledge, skills, and attitudes all students should retain (American Association for the Advancement of Science, 1989).

The *Benchmarks for Science Literacy* was published after *Science for All Americans* to provide guidelines for what all students should know and be able to do in science by the end of grades 2, 5, 8, and 12 (American Association for the Advancement of Science/Project 2061, 1993). Although these grade levels offer reasonable checkpoints, the publication does not suggest a rigid formula for teaching. It is a guide, which educators can use to design curricula to meet their students' needs and meet the goals of *Science for All Americans*, with the focus on understanding the interconnections of key concepts and relevancy for any career path.

In 1989, the National Governors Association endorsed setting national education goals. Several science education associations along with the U.S. Department of Education encouraged the NRC to play a leading role in the efforts to develop national standards for science education in content, teaching, and assessment. The NSES, released in 1996, provide

criteria to judge the quality of what students know and are able to do; the quality of the science education programs that provide the opportunity for students to learn science; the quality of science teaching; and the quality of the assessment practices and policies. The NSES provide the criteria to judge the progress toward a national vision of teaching and learning (National Research Council, 1996a).

A Nation at Risk (National Commission on Excellence in Education, 1983) scrutinized public education and propelled the need for educational reform to the top of the political agenda. The belief that the achievement of U.S. students was falling behind other countries led to the standards based movement of accountability and high-stakes testing to evaluate the quality of instruction and learning (Amrein & Berliner, 2002; Baker & Foote, 2006). In 1998, the poor performance of U.S. secondary school students on the TIMSS raised serious concerns about the state of education in the US. United States students scored well below the international average on the TIMSS for mathematics and science (U.S. Department of Education, 2003). The 2007 TIMSS for 8th grade mathematics and science scores place the United States below Singapore, Chinese Taipei, Japan, Republic of Korea, England, Hungary, Czech Republic, Slovenia, Hong Kong, and Russian Federation (National Center for Education Statistics, 2007a). There was no detectable change in U.S. 4th graders' science achievement from 1995 to 2007 (National Center for Education Statistics).

Countries with high science achievement share common characteristics, which include: a vision of what all students in each grade should learn, with a focus on a few topics in depth both in textbooks and instruction; well prepared teachers who consult regularly with other teachers and other resources; and alignment between what is expected, taught, and

tested (National Science Board, 1999). In its report, the National Science Board brought attention to the state of science and mathematics education in the US, and emphasized the need for world class achievement in science and mathematics education because it is critically important to our Nation's future (National Science Board).

Stedman (1997) reviewed the evidence from the major international assessments of the past two decades including the *Third International Math and Science Study* (TIMSS) and *International Assessment of Educational Progress*. He asserts that the US performance was not consistently poor as some have claimed, but varied by subject and grade. Contrary to a common misconception, the assessments have not compared masses of students in the US to small academic elites in other countries. Our youngest students have done well, even in science, and our reading is one of the best in the world. In contrast, our high school math and science performances have been poor. It is not a lack of coverage; in fact, our students cover more material. Stedman identifies the serious problem of ineffective teaching and learning. Stedman, and Charles and Shane tell us the longer our students are exposed to our school system, the weaker the student, and both use the phrase, "mile-wide and an inch deep" to describe the math and science curriculum in the US (Charles & Shane, 2006; Stedman, 1997, p. 12).

Growing concerns led to the passage and implementation of state and federal mandates intended to improve the education of disadvantaged students, and accountability emerged as a driving force to improve public education. One of the first National accountability efforts was the passage of the *Title 1 of the U.S. Elementary and Secondary Act of 1965* (U.S. Department of Education, 2004b, public law 89-10), which was passed to

ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education. The *National Assessment of Educational Progress* (NAEP) (U.S. Department of Education Institute of Education Sciences, 2010) and *NAEP Assessment Authorization* authorized the use of NAEP for state-by-state comparisons.

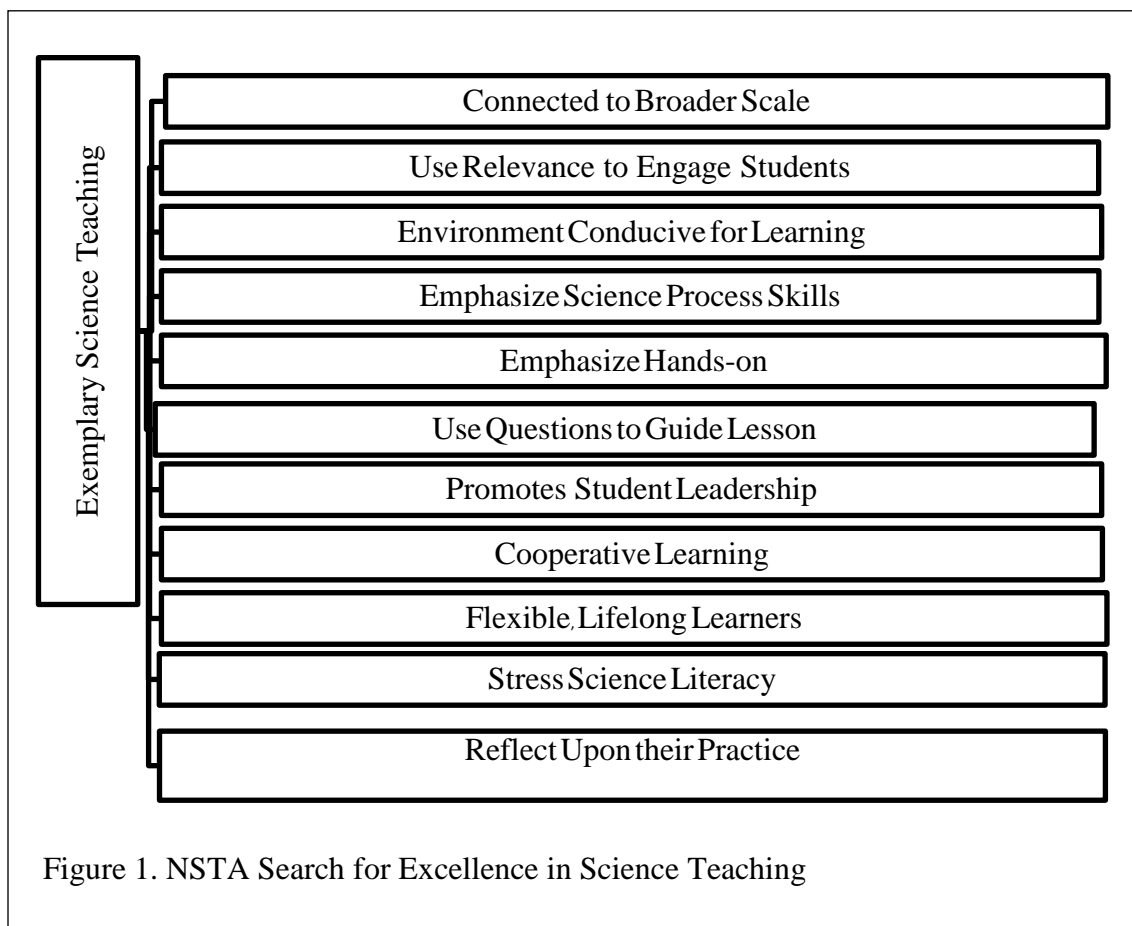
The passage of the *No Child Left Behind Act of 2001* (NCLB) (107th U.S. Congress, 2001) provided a comprehensive reauthorization of the *Elementary and Secondary Education Act of 1965*, which incorporates specific proposals for testing, accountability, parental choice, and early reading. NCLB authorized a number of federal programs aimed at improving the performance of primary and secondary schools. It mandated that states give students annual standardized tests and show improvement for all students to be proficient by 2014. The Act also reauthorized the National Center for Education Statistics and created the *Institute of Education Sciences of 2002* to carry out a coordinated agenda of research, statistics, and evaluation relevant to the educational challenges of the nation (U.S. Department of Education, 2009a). Our nation's ability to remain competitive in a global market renews the urgency to improve Science Education in era of high-stakes testing.

The Search for Excellence in Science Teaching

As the need to improve science education in the US became a national priority, the NSTA funded a search for excellence in science teaching. The search began in the 1980s, and over the next decade three prominent science educators, Penick and Bonnstetter (1993) and Yager (2000) reported their findings in science education journals. They found exemplary science teachers have taught longer, stay in the same district, and have more hours and degrees beyond the bachelor level (Penick, 1983, 1984, 1985, 1989, 1992, 1995; Penick &

Bonnstetter, 1989; Penick & Yager, 1983, 1985, 1986; Penick, Yager, & Bonnstetter, 1986; Tobin & Fraser, 1990; Varrella, 2000; Yager, 1996; Yager & Penick, 1985, 1992). These teachers put in far more than minimal time, they use a well-researched and valid rationale for teaching science, and they tend to be older and more experienced (Penick, 1989, 2000; Penick & Bonnstetter, 1993). Penick et al. (1986) also found that these teachers attend and present at professional meetings, and are aware of national curricular trends.

The Expert Science Teaching Evaluation Model developed by the Center for Research on Educational Accountability and Teacher Evaluation, defined expert science teaching, developed instruments to assess, and developed a science teaching model (Burry-Stock & Oxford, 1994). Between 1990 and 1993 they studied 200 4th through 8th grade teachers from several states to define exemplary science teaching. They found science teachers need to be knowledgeable about science, provide a stimulating environment for students, and facilitate the understanding of concepts. They found that the development of expertise in science teaching requires an understanding of the learning environment, and the context of teaching is crucial to the success of teaching science. This along with the search for excellence in science teaching provides a framework for the criteria to be an exemplary science teacher (See Figure 1).



Science Teachers Provide Relevance. The search for excellence found that exemplary science teachers include an exploration of a variety of science careers during instruction, know how scientific knowledge is applied, and encourage their students to become concerned citizens (Burry-Stock & Oxford, 1994; Penick et al., 1986). Schools that use Science-Technology-Society (STS) focus on relevant topics for students. These topics include: energy, population growth, DNA technology, environmental quality, natural resources, sociology of science, and the effects of technological development (Penick & Yager, 1985). Students are involved in problem solving and resolutions. Teachers and students are excited about school because they see school as an integral part of their

community. Barriers between schools and communities break down when adults and students find resolutions to real problems (Yager & Penick, 1985). Learning is influenced in fundamental ways by the context in which it takes place. A community centered approach requires the development of norms for the classroom and school, as well as connections to the outside world (Burry-Stock & Oxford, 1994).

Science Teachers Provide a Positive Classroom Environment. Learner centered environments pay careful attention to the knowledge, skills, attitudes, and beliefs that learners bring with them to school. Teachers who use a learner centered approach recognize the importance of building on their students' conceptual and cultural knowledge, and they are sensitive to the needs of their students. (Bransford, Brown, & Cocking, 2000). Exemplary science teachers are committed to creating an environment where learning can take place. The teacher uses inquiry, provides a trusting environment, has time to plan, and the resources for students to engage in inquiry (Craven III & Penick, 2001; Penick, 1984, 1995, 2000; Penick & Yager, 1983, 1986; Tobin & Fraser, 1990; Yager & Penick, 1992). These exemplary teachers foster a "working with" classroom climate. These teachers also demonstrate mutual respect between the teacher and students with less emphasis on facts and more on thinking, listening, and problem solving (Varrella, 2000).

Effective and successful teachers provide a stimulating, accepting environment, have high expectations of themselves and students, are models of inquiry, and expect students to question facts, teachers, and knowledge (Penick & Yager, 1986). The atmosphere is more casual than traditional, and students are active in experiential inquires and problem-solving (Varrella, 2000). Tobin and Fraser (1990) found exemplary science teachers use management

strategies that sustain student engagement. They monitor student behavior by moving around the room and maintain control of the class at a distance. They also establish a routine, which created a less frantic classroom setting without the teacher moving hurriedly from one student to the next.

The norms established in classrooms have a strong effect on students' achievement. Teachers design classrooms and activities that help students to organize their work with a sense of camaraderie and community. Teachers can improve instruction and student achievement with collaborative and consistent scoring guides, assessments that identify what was taught well and what needs to improve, and provide opportunities for students to resubmit their work (Bloom, 1971; Burrill, 2001; Burry-Stock & Oxford, 1994; Guskey, 2003; Leinwand & Groves, 2002; Reeves, 2000).

Science Teachers Emphasize Process Skills and Hands-on Activities. Exemplary science teachers encourage students to suggest causes for events and situations, and they encourage students to predict the consequences of their ideas and experiments (Penick et al., 1986; Penick & Bonnstetter, 1993). Teachers go beyond the textbook to context-based instruction and applied the principles of Science-Technology-Society. Their instructional strategies include daily hands-on activities, flexibility, motivating questions, and students doing the work, with the teacher acting in a supervisory, management, and resource role. They place an emphasis on understanding methods of science and science content, instead of rote learning of facts (Varrella, 2000).

Science Teachers Use Questions to Guide the Lesson. Penick et al. (1986) found exemplary science teachers seek out and use student questions and ideas to guide the lessons,

even if it means changing the lesson plan. Students' ideas are sought before presenting teacher ideas, ideas from textbooks or other sources. In these classrooms, students ask each other questions, as much as they ask the teacher. Students are active in experiential inquires and problem solving. Teachers use higher-order and open-ended questioning strategies, and encourage students to elaborate on their questions and responses from written materials, experts, and experiments (Varrella, 2000). Teachers allow adequate wait time for student responses and time for reflection and analysis to reformulate concepts and ideas in light of new experiences and evidence Penick et al. The teachers encourage students to challenge each other's ideas and conceptualizations, and they respect and use all ideas that students generate (Penick et al., 1986) The Iowa Chautauqua Program and the Iowa Scope, Sequence, and Coordination found student-centered methods that emphasize the use of student questions, planning ways for students to find answers, and students' conducting their own experiments and research, also increase student achievement (Varrella, 2000).

Science Teachers Promote Student Leadership and Cooperative Learning.

Exemplary science teachers promote student leadership and use cooperative learning strategies that emphasize collaboration. They encourage their students to present information and ideas at school board meetings, city council meetings, write letters to editors and articles for publication (Penick et al., 1986; Yager, 1996, 2000). Tobin and Fraser (1990) found teachers who involve all students in learning activities will also have students who enjoy working independently and in cooperative groups. Penick (1985) suggests instead of telling students every last detail, let students figure it out and make more decisions on their own, and student test scores will increase.

Science Teachers are Flexible, Lifelong Learners, and Stress Science Literacy.

Exemplary science teachers are open, flexible, knowledgeable, accepting, consistent, and they enjoy teaching in a classroom rich in media, current events, ideas and action (Penick et al., 1986). They show an interest in reading, talking, listening, and stimulating discussion by asking broad, general questions rather than questions that require specific knowledge, and they consider all answers (Penick & Yager, 1986). They model the desired student behavior, and they are inquisitive, investigative, tenacious, creative, and communicative (Penick & Yager). Exemplary science teachers also reveal their own thinking and logic using questions and comments. They stress science literacy, apply knowledge, do not view the classroom walls as a boundary, and they are flexible in their time, schedule, and curriculum (Penick, 1989; 2000; Penick & Bonnsetter, 1989, 1993). They are committed lifelong learners, show consistency between what they did in practice and their philosophy of teaching strategies (Varrella, 2000).

Pedagogical Context Knowledge

Barnett and Hodson (2001) introduced the term pedagogical context knowledge, or teacher knowledge, and they propose this type of knowledge is a synthesis of four kinds of knowledge: academic and research knowledge, content knowledge, professional knowledge, and classroom knowledge. It is demonstrated when teachers guide, focus, challenge, and encourage student learning for all stages of inquiry. Tobin and Fraser (1990) found exemplary science teachers can answer student questions, carefully plan what students would do next, and reflect on the lesson as it progresses. They are constantly making decisions about; how to engage, when to change directions, when to foster a student's particular

interest, and how to use opportunities to model scientific skills and attitudes (Burry-Stock & Oxford, 1994). Knowing when to push students a little harder or when to pull back and allow students to discover on their own, is the art of teaching, regardless of the discipline (Barnett & Hodson, 2001). These teachers are accustomed to change and reflect continually upon their practice (Kimble, Yager, & Yager, 2006).

A review of the science education literature provides a description of exemplary science teaching. Exemplary teachers are connected on a broader scale within their profession and community. They use relevance to engage students' interest and provide connections to the world beyond the classroom. They create a learner centered environment conducive for learning. They emphasize science process skills, provide laboratory experiences, and stress science literacy. They use questions to help guide the lesson and monitor student learning. They provide opportunities for student leadership and cooperative learning. They are flexible and adjust the lesson as needed. They are also lifelong learners and reflect upon their practice.

National Science Education Standards

The National Research Council (NRC) released the *National Science Education Standards* (NSES) in 1996 after almost five years of work and the involvement of thousands of scientists, educators, parents, and community stakeholders. The NSES represents a vision of scientific literacy. It is what every student should understand and be able to do in science for the 21st century. The four goals of the NSES include: science is for all students, learning science is an active process, school science reflects the intellectual and cultural traditions that characterize the practice of contemporary science, and improving science education is part of

systemic education reform. The NSES are meant to ensure that all students experience the richness and excitement of understanding the natural world and use appropriate scientific processes. The goals intend for all students to engage intelligently in public discourse about science and increase their economic productivity through the use of knowledge, understanding, and skills of the scientifically literate. Scientific literacy also enables us to use the principles and processes of science to make personal and societal decisions (National Research Council, 1996).

The NSES are not a federal mandate for a national curriculum, examination, or certification. The NSES are not an endorsement of a single teaching method (National Research Council, 1996). The NSES complement *Benchmarks* in providing a way to judge the quality of teaching, professional development, assessment, programs, and educational systems (Close, 1996). The NSES provide fundamental rules that are different from the reforms of the 1960s; science is now cast in real world contexts in terms of problems, current issues, and personal curiosity related to the daily lives of students. The context for learning is understood to be as important as the concepts and processes (Yager, 2000).

The NSES provide a vision for preparing new teachers and encourages teachers to continue to grow. The NSES emphasize the integration of science and teaching knowledge, theory and practice in school settings, collegial and collaborative learning, and long-term coherent plans. The NSES suggest a variety of professional development activities, which mix internal and external expertise to provide opportunities for teacher leadership (Appleton, 1997; Bransford, Brown, & Cocking, 2000; Close, 1996; Collins, 1997; Kimble et al., 2006; Yager, 2000).

The NSES suggest a systemic change is required throughout, which includes central office administrators, building administrators, departmental support, and it involves parents and the community. Without the support of all stakeholders, it is more difficult, but not impossible, to achieve the National Standards. How students are taught influences what students learn. The science teachers' perception of the nature of science has an influence on their decisions of how science is taught and how it is to be learned (National Research Council, 1996). The relationship between teacher and student also influences student learning (National Research Council; Weeks, 2003; Bottoms, 2004).

The NSES are grounded in inquiry and provide the criteria for judging the quality in students' knowledge base. The NSES also provide the criteria for judging teaching excellence, professional development for teachers, assessment practices, and programs and systems that support effective science teaching. Exemplary science teachers show how to use inquiry by pursuing ideas, questioning knowledge, and proposing new solutions (National Research Council, 1996). Learning science is an inquiry-based process, and schools need to reflect the intellectual traditions of contemporary science. All Americans have a role in science education reform (National Research Council, 1996).

Learning science is an active process of observing, inferring, and experimenting; by using inquiry students describe objects and events, ask questions, construct explanations, test those explanations, and use communication skills to convey their ideas to others (National Research Council, 1996). The NSES encourage teachers to have students engage in extended investigations, as well as provide a safe working environment that has appropriate space and materials to work with. Exemplary science teachers provide opportunities for students to

participate in oral and written discourse to focus their attention on what they know, why it is important, and help them connect their knowledge to other domains (Appleton, 1997; Bransford, et al. 2000; National Research Council, 1996; Kimble, et al., 2006). These teachers also invite their students to explore the world of science with them and allow students to have wonderful ideas, make connections themselves, and discover solutions to their own problems (Haley-Oliphant, 1994).

Vygotsky (1978) suggests knowledge is socially constructed and learning is a dynamic activity within a community of practice. The NSES support students being actively engaged in constructing their knowledge through individual and social processes, and constructivism provides a sound theoretical foundation for scientific inquiry (Staver, 1998). Constructivism can provide teachers with appropriate teaching methods and provide an opportunity for students to arrive at solutions for science problems (Appleton, 1997). In a constructivist and equitable classroom environment, Alsop, Bencze, and Pedretti (2005) found exemplary science teachers guide their students towards independent scientific inquiry; use problem based conceptualized learning, and interpret science and technology as a socially embedded enterprise for informed and responsible decision making. Recent research for teaching in the 21st century compels educators to engage prior understandings that learning is constructed on a foundation of extant understandings and experiences (Bybee, 2006).

The NSES provide a vision for preparing new teachers and encourages in-service teachers to continue to grow in the profession. The NSES emphasize the integration of science and teaching knowledge, integration of theory and practice in school settings, and

collaborative learning. The NSES also include long-term coherent plans, a variety of professional development activities, which mix internal and external expertise to provide opportunities for teacher leadership in a collegial learning community (Appleton, 1997; Bransford et al., 2000; Close, 1996; Collins, 1997; Kimble et al., 2006; Yager, 2005).

Teachers reflecting on their practice is the final element of the NSES. Reflection is circular and simultaneous because exemplary science teachers are using information from pedagogical content and context knowledge, student data, observations, and interactions with colleagues to assess, reflect, and learn from their own practice (National Research Council, 1996). The NSES identify the need for science teachers to reflect and analyze teaching models. The NSES challenge them to implement effective strategies and utilize self-reflection as an ongoing process throughout their professional lives (National Research Council, 1996). Teachers reflecting on their practice is Standard V of the new NCPTS (North Carolina Professional Teaching Standards Commission, 2009a).

The NSES apply to all students, regardless of gender, ethnicity, disability, aspiration, interest, or motivation (National Research Council, 1996; Scheurich, Skrla, & Johnson, 2000). The NSES expect teachers to develop communities of science learners who are respectful of diversity, attitudes, and social values conducive to learning. Teachers can nurture collaboration by encouraging students to accept the contribution of others, which helps students understand how science is achieved (National Research Council, 1996). The NSES and *Benchmarks* do not specify a uniform program or philosophy; instead, they can be interpreted and implemented in a variety of ways (Collins, 1997). The NSES and

Benchmarks do not diminish the responsibility of local and state agencies to design, implement, and assess instructional practices.

A 1996 survey of science teachers reveals they believe the NSES will help improve teaching, but barriers to the success include lack of time for planning and meeting with other teachers, insufficient money for teacher training, and inadequate teaching materials and facilities (Herman et al., 2008; Sommerfeld, 1996). While most educators agree with the NSES of learning through applications and problems, the NSES have been less successful in delivering “less is more” and departure from the traditional curriculum (Clune, 1998).

National Board for Professional Teaching Standards

While the NSES are applicable to science teaching and learning, there has also been a movement to improve teaching and learning for all teachers and students on a national scale. The quality of the teacher in the classroom is the most important factor for student achievement (Anderson, 1999; Ferguson, 1998; Goldhaber, 2002; Goldhaber, Brewer, & Darling-Hammond, 1999; Hanushek, Kain, & Rivkin, 1999; Rowan, Correnti, & Miller, 2002; Wright, Horn, & Sanders, 1997). In response to *A Nation at Risk: the Imperative of Educational Reform (National Commission on Excellence in Education, 1983)*, the Carnegie Forum on Education and the Economy established the Task Force on Teaching as a Profession. The task force examined teaching as a profession and presented its findings and policy recommendations in 1986 by issuing *A Nation Prepared: Teachers for the 21st Century* (Harman, 2001). To make teaching a profession of well-educated teachers who are prepared to assume new powers and responsibilities, the Task Force recommended establishing a National Board for Professional Teaching Standards (NBPTS). The task force

did not recommend the replacement of state licensure; instead, experienced teachers who demonstrated this expertise would help the public see teaching as a profession instead of an occupation (National Board for Professional Teaching Standards, 1987a).

The NBPTS was created in 1987 to develop a voluntary system to assess and certify teachers, establish high and rigorous standards, and advocate educational reforms, which improve student learning. Shortly thereafter, NBPTS issued its first policy statement *What Teachers Should Know and Be Able to Do*. This policy consisted of five core propositions which frame the knowledge, skills, dispositions and beliefs that characterize National Board Certified Teachers (NBCT). The five core propositions are:

- Teachers are committed to students and their learning.
- Teachers know the subjects they teach and how to teach those subjects to students.
- Teachers are responsible for managing and monitoring student learning.
- Teachers think systemically about their practice and learn from experience.
- Teachers are members of professional learning communities (National Board for Professional Teaching Standards, 2007).

Over 10% of North Carolina's teachers have achieved National Board Certification (North Carolina Department of Public Instruction, 2009c). North Carolina followed by Florida and South Carolina leads the nation in the number of teachers with certification from the NBPTS (North Carolina Department of Public Instruction, 2009b; Southern Region Education Board, 2009). Support from the state of North Carolina for teachers who pursue this certification includes: the assessment fee, three days of paid release time for candidates, renewal credit for those teachers completing all components, and a salary differential of 12%

of their state salary for 10 years, the life of the certificate. The North Carolina State Board of Education has adopted policy recommendations, which include:

- adopting the core propositions of the NBPTS,
- granting NC teaching license to out of state teachers who possess National Board Certification,
- creating staff development plans that incorporate the work of NBPTS,
- developing plans to incorporate NBPTS into higher education programs (North Carolina Department of Public Instruction Accountability Services Division, 2009b).

The philosophy of NBPTS for science is based on the assumption that students learn best when they are physically and mentally engaged through experience-based activities in science. Students need to be provided with opportunities to think about what they have been seeing and doing in order to develop a deeper understanding of scientific concepts. Students benefit when they explore science concepts and have opportunities to share and test their ideas with a larger team of investigators. Science teachers also have the responsibility to help their students develop the habits of mind that enhance scientific literacy (National Research Council, 1996; North Carolina Professional Teaching Standards Commission, 2009b; Penick, 1984). If North Carolina is going to have a greater impact on a larger number of teachers and students, additional teaching standards are needed for all teachers. Darling-Hammond (1999) reports state policies regarding teacher education, licensing, hiring, and professional development may make an important difference that teachers bring to their work.

National Board for Professional Teaching Standard 5 (National Board for Professional Teaching Standards, 1987b), North Carolina Professional Teaching Standard I

(North Carolina Professional Teaching Standards Commission, 2006), and the National Science Education Standard F (National Research Council, 1996a, p. 51) provide the following descriptors of an effective teacher:

- Teachers demonstrate leadership among staff and administration.
- Teachers make the content engaging relevant, and meaningful to students.
- Teachers provide opportunities for students to demonstrate critical thinking and problem solving.
- Teachers facilitate instruction for all students to discover how they learn, how to work with others, and how to communicate their ideas.
- Teachers use diverse instructional strategies.
- Teachers engage students to ensure a disciplined learning environment.
- Teachers organize instruction to meet goals and objectives.
- Teachers use multiple methods to assess the class and individual progress.
- Teachers connect with families and the community.
- Teachers critically examine and reflect upon their practices.
- Teachers are familiar with learning theories, instructional strategies, and understand the current issues in American education.

How People Learn

Research on how people learn emphasizes learning with understanding, instead of learning facts from a textbook and tests which assess students' abilities to remember facts. The science of learning show experts' ability to think and solve problems depends on a rich body of knowledge about the subject matter (Bransford et al., 2000). In *How People Learn Brain, Mind, Experience, and School*, Bransford et al. report knowledge is connected and organized around important concepts that are applicable and transferable to other contexts. People construct knowledge and understanding based on what they already know and believe (Vygotsky, 1978). Learning can be enhanced when teachers' pay attention and use students' knowledge and beliefs as a starting point for new instruction and monitor students' changing conceptions (Bransford et al., 2000).

NCPTS III expects teachers to know how to direct students' curiosity into an interest in learning. Teachers are expected to recognize the interconnectedness of content areas/disciplines. NCPTS IV expects teachers to know how students think and learn and understand the influences on student learning and differentiate instruction. It also expects teachers to encourage students to ask questions, think creatively, develop and test innovative ideas, synthesize knowledge and draw conclusions. This includes: helping students exercise and communicate sound reasoning, understand connections, make complex choices, and frame analyze and solve problems (North Carolina Professional Teaching Standards Commission, 2006).

NSES A and NBPTS entry B expects science teachers to plan inquiry based lessons for their students (National Research Council, 1996a). Bransford et al. (2000) report younger

children in elementary classes that utilized inquiry-based instruction were more likely to understand the concepts in higher level high school science classes. Students come to the classroom with preconceptions about the world around them. If teachers fail to engage students' preconceptions in the learning process, students may not understand new concepts and information or students may learn the information for the test and revert to their preconceptions outside the classroom. Bransford et al. (2000) identify the need for science teachers to build on the knowledge students have already learned.

Braund and Hames (2005) interviewed 59 students at the end of primary school, year 6, and 48 students in year 7 at the beginning of secondary school to ascertain their aspirations and fears concerning secondary science, their reactions to bridging work, and their memories of investigation. They found students repeated similar work with no increased challenge. Teachers' style of teaching and language can be very different in high school and teachers often fail to make use of their students' previous science learning experiences. Secondary teachers may distrust the assessed levels of performance on national science tests taken at the end of primary school; this may be the reason for starting from scratch when planning their instruction. Braund and Hames (2005) cite numerous studies, which indicate repetition as one of the most important sources of frustration and lack of motivation for students in secondary schools, and a key factor causing a decline in attitudes toward science. NCPTS III expects teachers to know the links between grade/subject and teach the NC SCOS. Teachers are expected to know the links and vertical alignment of the grade or subjects they teach and the NC SCOS. Teachers are expected to understand how the content they teach relates to other

disciplines in order to deepen understanding and connect learning for students (North Carolina Professional Teaching Standards Commission, 2006).

The second principle from *How People Learn* is a deep foundation of factual knowledge students must develop to have the competence to understand facts and ideas in the context of a conceptual framework, and ways to organize knowledge so it can be retrieved and applied (Bransford et al., 2000). The ability to plan task, notice patterns, explain and make analogies is intertwined with facts. Bransford et al. identify the necessity of having a deep understanding of the subject matter to be able to transform this information into useable knowledge, it isn't sufficient to know a large set of disconnected facts. Teachers need to provide many examples where the same concept is at work, and provide a foundation of factual knowledge. NCPTS IV expects teachers to encourage students to ask questions, think creatively, develop and test innovative ideas, synthesize knowledge and draw conclusions. This standard also expects teachers to bring a richness and depth of understanding for each lesson (North Carolina Professional Teaching Standards Commission, 2009c).

In-depth study often requires that ideas span more than a single school year in order for students to make the transition from informal to formal ideas; this will require coordination across school years, which requires teachers to have an understanding of the growth and development of students' thinking about these concepts. The implication for state assessments is accountability for deep understanding rather than surface knowledge. The NCPTS III also expects teachers to know the links and vertical alignment of the grade or subject they teach and the NC SCOS (North Carolina Professional Teaching Standards

Commission, 2006). Teachers who recognize the interconnectedness of content areas and disciplines help make instruction relevant to students.

Another new development in the science of learning reported by Bransford et al. (2000) and a third principle of *How People Learn* is the importance of metacognition, which helps people monitor their own learning. Metacognitive knowledge includes an emphasis on making students aware of and responsible for their learning (Anderson et al., 2001). Students' awareness and control of their own cognition are important roles in learning. This knowledge includes the effectiveness of various strategies for different tasks, and what the learner needs to do to understand, learn, and remember information (Anderson et al., 2001). Self-monitoring is an important principle in *How Students Learn Science in the Classroom* (Donovan & Bransford, 2005). Classroom environments that help students be more metacognitive about their own thinking and learning typically emphasizes self-assessment (Donovan & Bransford, 2005). These skills should be integrated into the curriculum in a variety of subject areas because these skills vary across grade levels and subject areas (Bransford et al., 2000).

NCPTS IV expect teachers to facilitate learning for their students using multiple indicators, both formative and summative to evaluate student progress, and provide opportunities for self-assessment (North Carolina Professional Teaching Standards Commission, 2009c). This standard also expects teachers to provide opportunities, methods, feedback, and tools for students to assess themselves and each other (North Carolina Professional Teaching Standards Commission, 2006). NSES A expect teachers to select teaching and assessment strategies that support the development of students understanding

and nurture a community of science. NSES B expect teachers to challenge students to accept and share responsibility for their own learning. NSES C expect teachers to guide students in self-assessment (National Research Council, 1996).

A study in Israel investigated the effects of metacognitive instruction embedded within an asynchronous learning network on scientific inquiry skills (Zion, Michalsky, & Mevarech, 2005). The reforms in science education include an emphasis of the importance of providing inquiry learning opportunities for students. Many students are capable of constructing their knowledge through inquiry to complete all the stages of scientific investigations including making an observation or investigating a phenomena, formulating a hypothesis, controlling variables, gathering data, making an analysis, and drawing conclusions. However, it cannot be achieved by placing students in the midst of a complex experiment for it to have the same effect (Zion et al., 2005).

Gardner's "theory of multiple intelligences conceptualizes intelligence as a bio-psychological potential to process information that can be activated in a cultural setting to solve problems to create products that are of value in a culture" (Gardner, 1999, p. 5). Bransford et al. (2000) suggest that multiple intelligences theory offers opportunities to modify traditional curricula and represent key concepts in a variety of ways for students to demonstrate their understanding. Classroom environments that incorporate multiple pathways for learning to occur enhance student learning and the classroom environment. In *How People Learn*, Bransford et al. (2000, p. 236) states, "there is no universal best teaching practice." Just as a carpenter uses many tools, the teacher selects an appropriate learning activity.

NCPTS V identifies the need for teachers to participate in continued, high quality professional development (North Carolina Professional Teaching Standards Commission, 2006). The NSES have also set standards for teachers' professional development. These four standards for science teachers include: learning essential content through perspectives and methods of inquiry; integrating knowledge of science to connect; integrating all pertinent aspects of science and science education; building and understanding the ability for lifelong learning; and being coherent and integrated with clear goals based on a vision of science learning (National Research Council, 1996).

Professional Learning Communities (PLC)

Many school systems in NC have adopted professional learning communities (PLC) for teacher and school improvement. The PLC model emphasizes faculty commitment to improving student learning, high levels of collaboration, and regular reflection on student and school data (Bransford et al., 2000; DuFour, 2004). This practice is reflected in the NSES, which advocate teachers working together as colleagues within and across disciplines and grade levels. NCPTS IV identifies the need for teachers to collaborate with colleagues, use data for short and long range planning, engage students in the learning the objectives, monitor and modify lessons to enhance student learning, and respond to cultural diversity and the learning needs of students (North Carolina Professional Teaching Standards Commission, 2009c).

A study by Graham (2007) found the following contributing factors are essential to the success of a PLC: leadership, organizational practices, substantive details of PLC activity meetings, the nature of conversations in PLC activities, and the development of

community among PLC teams, which has the potential to achieve significant improvements in teaching effectiveness. Graham reports teachers' professional growth from participating in a PLC depends on the sense of community and respect teachers establish in the group.

Teachers benefit by sharing instructional strategies, making decisions about curriculum and assessment practices, and analyzing student achievement data. Teachers can learn from each other and make improvements in what they teach and how they teach it.

NCPTS V identifies the need for teachers to participate in continued, high quality professional development (North Carolina Professional Teaching Standards Commission, 2006). The NSES have also set standards for teachers' professional development. These four standards for science teachers include:

- learning essential content through the perspective and methods of inquiry,
- integrating the knowledge of science to connect and integrate all pertinent aspects of science and science education,
- building an understanding for lifelong learning,
- integrating clear goals based on a vision of science learning (National Research Council, 1996)

Influential School Policies

Desimone, Smith, and Phillips (2007) studied professional development policies that have been effective for teachers to improve teaching and learning. They used a national sample of high school mathematics and science teachers to examine if there is a difference between teachers of high-stakes mathematics and low-stakes science. They found both math and science teachers who are more involved in setting school policy are more likely to

participate in professional development, which includes: observing other schools and classrooms, network with other teachers, collaborations, and mentoring. The high-stakes environment motivated teachers to seek professional development that is most likely to help students meet state content standards. This is consistent with the North Carolina Working Conditions Survey, that was instrumental in the development of the NCPTS I. Teachers demonstrate leadership by participating in decision-making structures, promote professional growth, analyze data, advocate for positive change in policies and practices affecting student learning, and participate in the implementation of initiatives to improve education (North Carolina Professional Teaching Standards Commission, 2006).

Assessment Centered Environments

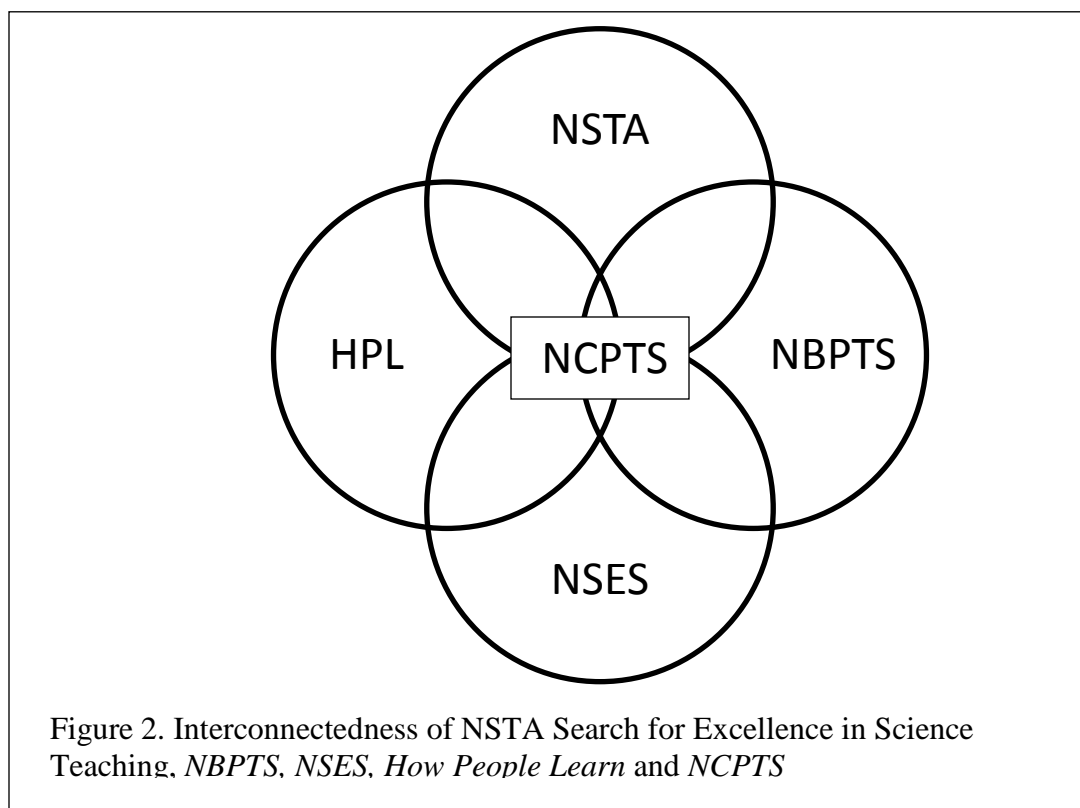
Knowledge centered classrooms strive to create environments which foster an integrated understanding of a discipline instead of knowledge and skills that are disconnected. In addition to being learner and knowledge centered, effective learning environments are also assessment centered (Bransford et al., 2000). Appropriate assessments provide opportunities for feedback and revision. Formative involves the use of assessments as sources of feedback to improve teaching and learning. Summative assessments measure what students have learned at the end of some set of learning activities. Effective teachers use multiple indicators, including formative and summative assessments, to evaluate student understanding and learning (North Carolina Professional Teaching Standards Commission, 2009a).

Teachers monitor group and individual performances and assess students' abilities to link their current activities to other parts of the curriculum and their lives. They also help

their students build self-assessment skills as well as the work of their peers. Teachers often provide summative feedback for test grades, papers, worksheets, homework, and report cards. Formative assessment feedback occurs when students have the opportunity to use it to revise their thinking as they are working on a unit or project (Bransford et al., 2000). Many assessments developed by teachers as well as many standardized tests used for accountability emphasize memory for procedures and facts. Assessments can involve many possible combinations of content knowledge and process skills. Standard IV of the NCPTS expects teachers to use formative and summative data for short and long range planning (North Carolina Professional Teaching Standards Commission, 2006).

Interconnectedness of the NSTA Search for Excellence in Science Teaching, NBPTS, NSES, How People Learn, and NCPTS

The NSTA Search for Excellence in Science Teaching, NSES, NBPTS, *How People Learn*, and NCPTS are separate but overlapping and interconnected documents (see Figure 2). The following review of these documents weaves together a description of an exemplary science teacher. The NCPTS is the most recent document and reflects best practices found in the NSES, NBPTS, *How People Learn*, and the NSTA Search for Excellence in Science Teaching. Being an exemplary science teacher is complex and multidimensional as reviewed in the literature. The NCPTS are now in place for all teachers in NC to use and be evaluated. These standards provide clear expectations for teachers to help improve teaching and learning in NC. How they are being interpreted and used by NC High School Biology teachers is the purpose of this research.



North Carolina Professional Teaching Standards

The North Carolina State Board of Education adopted the North Carolina Professional Teaching Standards in June 2007. These standards are the basis for teacher preparation, evaluation, and professional development. The mission of the North Carolina State Board of Education states that “every public school student will graduate from high school, globally competitive for work and post-secondary education, and prepared for life in the 21st century” (North Carolina State Board of Education, 2006a). The North Carolina Professional Teaching Standards include:

1. Standard I: Teachers demonstrate leadership.
 - Teachers lead in their classrooms.

- Teachers demonstrate leadership in the school.
- Teachers lead the teaching profession.
- Teachers advocate for schools and students.
- Teachers demonstrate high ethical standards

2. Standard II: Teachers establish a respectful environment for a diverse population.

- Teachers provide an environment in which each child has a positive, nurturing relationship with caring adults.
- Teachers embrace diversity in the school community and in the world.
- Teachers treat students as individuals.
- Teachers adapt their teaching for the benefit of students with special needs.
- Teachers work collaboratively with students' families and significant adults.

3. Standard III: Teachers know the content they teach.

- Teachers align their instruction with the NC Standard Course of Study
- Teachers know the content appropriate to their teaching specialty.
- Teachers recognize the interconnectedness of content areas/disciplines.
- Teachers make instruction relevant to students.

4. Standard IV: Teachers facilitate learning for their students.

- Teachers know the ways in which learning takes place, and they know the appropriate levels of intellectual, physical, social, and emotional development of their students.
- Teachers plan instruction appropriate for their students.
- Teachers use a variety of instructional methods.

- Teachers integrate and utilize technology in their instruction.
- Teachers help students develop critical thinking and problem-solving skills.
- Teachers help students work in teams and develop leadership qualities.
- Teachers communicate effectively.
- Teachers use a variety of methods to assess what each student has learned.

5. Standard V: Teachers reflect on their practice.

- Teachers analyze student learning.
- Teachers link professional growth to their professional goals.
- Teachers function effectively in a complex, dynamic environment (North Carolina Professional Teaching Standards Commission, 2009a).

Koppich, Humphrey, and Hough (2006) found few teachers in low-performing schools have achieved NBCT status, in comparison to high-performing school. The NCPTS is to be used to evaluate teachers regardless whether the school is identified as exemplary or low performing. Teachers are a primary influence for the improvement of student achievement (Darling-Hammond, 1999). Improved student achievement is the driving force of NBPTS, NCLB, and NCPTS. The NCPTS expects teachers to “think systematically and critically about learning in their classroom: why learning happens and what can be done to improve student achievement” (North Carolina Professional Teaching Standards Commission, 2009b, p. 4). The NCPTS expects teachers to collect and analyze student performance data to improve effectiveness and adapt their practice based on research and data to meet the needs of a diverse population of students (North Carolina Professional Teaching Standards Commission, 2009b).

The NCPTS expects teachers to encourage all students to use 21st century skills, so they discover how to learn, be innovative, collaborate, and communicate their ideas (North Carolina Professional Teaching Standards Commission, 2009b). The NCPTS expects teachers to teach 21st century content, which includes: global awareness, civic literacy, financial literacy, and health awareness. Teachers can also demonstrate the value of lifelong learning and encourage their students to learn and grow. They are expected to appreciate the differences and contributions of each student in the learning environment by building positive, appropriate relationships. Teachers can accomplish this by maintaining high expectations for students of all backgrounds (North Carolina Professional Teaching Standards Commission, 2009a).

High-Stakes Testing

High stakes testing and accountability emerged from the need to ensure all citizens received an adequate education in the nation's public schools. In 1987, Biology and Algebra 1 were the first North Carolina high school courses to have an End of Course Exam (EOC). Until this year, North Carolina administered 10 high school EOCs, along with state testing for computer competency, comprehensive writing, reading, and math tests for all high school students (North Carolina Department of Public Instruction, 2009a). The following tests have been eliminated for the school year 2010-2011: Computer skills test, Chemistry EOC, Geometry EOC, High School Comprehensive test of Mathematics, and the Physics EOC. The State Board of Education approved of removing these tests to facilitate school and student transition to the new mathematics curriculum, which will begin for the 2012-2013 school year. NC Legislature passed a senate bill to eliminate funding for most state administered

tests, which are not currently required by federal law or condition for federal grants (North Carolina Department of Public Instruction, Accountability Services Division, 2010). Biology remains one of the “high five” EOCs used to measure student achievement.

High-stakes testing has become the reform of choice and politicians have used accountability as their platform for election to an office. Testing has been used to measure student achievement and school quality as the mechanism to hold students and educators accountable (Jones, Jones, & Hargrove, 2003). Reports using tests to compare nations, states, school districts, schools, teachers, and students have become a basis for education reform. While these tests (HST) can be informative, the results may corrupt education practice in schools (Ryan, 2009). One of the typical effects of high-stakes testing in NC has been the narrowing of the curriculum, and less higher-order thinking and problem solving (Jones et al., 1999). Jones et al. acknowledged North Carolina’s model of accountability (ABC) uses public scrutiny and embarrassment to spur low performing schools to high achievement.

Eighteen states, including North Carolina, were involved in high-stakes testing prior to the passage of NCLB. The data from these states indicate these tests decrease student motivation and increase the number of students who drop out of school (Amrein & Berliner, 2003). Although these states showed higher assessment scores for their own tests, the National Assessment of Education Progress, SAT, ACT, and Advanced Placements scores did not improve. Nichols, Glass, and Berliner (2006) studied the National Assessment of Education Progress (NAEP) test data from 25 states and found the pressure of high-stakes testing has no real impact on student achievement. Instead, they found the negative impacts of these tests affect minority students through increased retention and dropout rates. The

United States subjects its students to more testing than any other industrialized nation (Amrein & Berliner, 2002, 2003).

Arguments for the support of high-stakes testing include: teachers need to be held accountable; students will work harder and learn more; students will be motivated to do their best; scoring well will lead to feelings of success; and scoring poorly will lead to an increased effort to learn (Amrein & Berliner, 2003). The unanticipated results of these tests include: rising transportation costs when students in low performing schools choose to attend high performing schools; the narrowing of the curriculum; higher rates of student retention, and property values based upon the school's performance (Amrein & Berliner, 2003). Research shows a disproportionate number of beginning teachers filling vacancies in low performing schools and cut backs in funding for the arts, as more emphasis is placed on these tests. High-stakes testing has led to litigation at every level and every state including: law suits by teachers versus administration, administration versus teachers, Exceptional Children versus the state, and English Language Learners versus the state (Amrein & Berliner, 2002; Manzo & Hoff, 1997; Murillo & Flores, 2002; Pringle & Martin, 2005).

Lomax, West, Harmon, Viator, and Madaus (1995) surveyed the data from 2,229 mathematics and science teachers of high and low minority classes and interviewed 289 urban educators to examine the impact of mandated standardized testing on curriculum and instruction in mathematics and science for minority students. They found standardized tests fail to adequately sample higher order thinking, high-level conceptual or high-level procedural knowledge in both subjects, and teachers of high-minority classes were more

likely to report negative impacts of standardized testing on teacher practice and minority student achievement in mathematics and science.

Teachers of high-minority classes engaged in more test preparation skills, which include: teaching test-taking skills, encouraging students to work hard and prepare, using test-motivating materials, teaching topics known to be on the test, providing test-specific preparation materials, providing students with items similar to those found on the tests, conducting more than 20 hours of test preparation, beginning at least a month before the test is administered, and using practice tests. These teachers also spent more instructional time in whole-group instruction, developing basic skills, and solving problems that are likely to appear on the tests. Teachers also agreed that mandated testing results in teachers' teaching to the test, leading teachers to go against their own ideals of good educational practice, and districts pressuring teachers to improve their accountability test scores (Lomax et al., 1995).

Jones et al. (1999) surveyed certified teachers in 16 elementary school in five school districts across North Carolina through a three-level stratified random sampling process according to geographic areas, balance of rural, urban, and suburban systems, designated performance on the 1997 end-of-grade tests. A total of 236 (50.2%) responded. The results showed that teachers spent the majority of the school day preparing students for the basics as defined in the ABCs program, including reading, writing, and mathematics. The data showed assessment drove instruction. The curriculum changed from hands-on instruction in science several times a week to using worksheets and relying on textbooks or no science at all. One school in the survey experienced 75% turnover due to low performance and the new teachers were indoctrinated into teaching with only the basics. The survey also indicated that the

ABCs program had a negative impact on students' love of learning. Social class remains the single most important variable that predicts school achievement.

Barksdale-Ladd and Thomas (2000) found 75 of the teachers they studied changed their instructional practices in response to high-stakes testing. Wideen, O'Shea, and Pye (1997) found a decrease in the variety of instructional approaches and strategies that promote inquiry. Wideen et al. also found the elementary and middle schools focus on the tested reading, writing, and mathematics. This led some principals to schedule less time for additional instruction for science, social studies, and the arts (Jones et al., 1999). Now that science is tested, Pringle and Martin (2005) found elementary teachers in Florida are teaching science. Eick (2002) reported the negative effects of traditional high-stakes testing has led to limited hands-on, problem solving, and inquiry instructional strategies. Vogler (2002) found positive changes in student achievement when teachers focus on best practices.

Westerlund, Upson, and Barufaldi (2002) compared the effects of EOC testing on the Biology curriculum in NC and TX, and found state standards and multiple-choice EOC take precedence over scientific inquiry. Six themes emerged from the analysis of the data, which include:

- staying on a task,
- a standardization of the curriculum,
- moving at the state's pace rather than the student's pace,
- teachers have become more adept at teaching a test than teaching knowledge,
- frustration in not being able to conduct hands-on activities such as projects, laboratory and field investigations,

- teachers could not teach topics that may interest students due to time restraints and EOC test topics.

Westerlund et al. (2002) found most of the effects of the Biology EOC are detrimental to students' ability to understand Biological concepts according to the NSES, as well as students from other countries who have demonstrated excellence in their understanding of science. Although the EOC may force some teachers who are not teaching the curriculum to improve, it also forces teachers to focus their creative energies on improving students' performance for one test. Teachers move ahead in the curriculum even when students have not mastered the previous topic. Biology teachers face the dilemma of embracing the NCPTS and hoping for better test results or continuing to follow the same path reported by Westerlund et al.

National Commission on Teaching and America's Future

The National Commission on Teaching and America's Future (NCTAF) (National Commission on Teaching and America's Future, 2007) reports that the inability to support high-quality teaching in many schools is not too few teachers coming in, but too many leaving the profession; this creates a staggering teacher attrition rate, which is significantly higher than other professions. It is estimated that almost a third of America's teachers leave during their first three years of teaching, and almost half leave after five years. The rates are higher in many low-income and/or rural communities. The attrition rate is 60% for individuals with an alternative licensing pathway. There is no current national policy to help manage the labor force in teaching, like the policies which helped in the 1960s and 1970s.

Without national information about vacancies, lack of license reciprocity and incentives for high demand locations, these statistics will not change (Carroll & Foster, 2010).

The National Commission on Teaching and America's Future, a 26 bipartisan member panel of governors, legislators, business leaders, community leaders, and educators investigated what it would take to enable every child in America to reach the new high standards of learning being enacted by states across the nation. The commission concluded that the recent reforms including: new curriculum standards, tests, and accountability schemes are unlikely to succeed without major investments in teaching (Carroll & Foster, 2010). The demands of subject matter standards and diverse student bodies require deeper content knowledge, pedagogical and diagnostic skills, and broader repertoires of teaching strategies (Darling-Hammond, 2000).

In *How People Learn*, Bransford et al. (2000) identify the need for research on education policy, which includes: review of state education standards and assessment tools, measures of student achievement that reflect the principles of *How People Learn*, review teacher certification and recertification requirements, and districts' policies for teachers' scheduled time for planning and reflection. Bransford et al. combine the strength of the research community with the insights gained from classroom practice. They identify 33 areas where further research is needed, and the NCPTS V expects teachers to keep abreast of evolving research and consider new ideas that improve teaching and learning.

Bransford et al. (2000) suggest new research is needed in emerging areas such as technology, which coincides with the NCPTS expectation for teachers to facilitate instruction using 21st century skills, for students to discover how to learn, be innovative, collaborate, and

be able to communicate their ideas. The NCPTS IV includes the use of formative assessments, which Bransford et al. identified as a need for further research. They also identify the need for a review of professional development programs that align with the principles of learning and effectiveness of teacher practice. NCPTS V identifies the need for teachers to participate in high quality professional development that reflects a global view of educational practices. The NSES encourages teachers to work together as colleagues within and across disciplines and grade levels, which is identified in NCPTS IV. The NSES expects teachers to select teaching and assessment strategies that support the development of student understanding and nurture a community of science learners; this is reflected in NCPTS IV.

Commission on 21st Century Education in STEM

The Commission on 21st Century Education in Science, Technology, Engineering, and Mathematics (2007), which reports to the National Science Board, the governing body of the National Science Foundation, has issued a report that recommends the formation of a new national council to coordinate efforts to improve the teaching of science and mathematics in schools and colleges. The report recommends that higher education should play a key role, including new standards for training mathematics and science teachers and the expansion of federal programs, to encourage these careers (Brainard, 2007a). The National Science Board asked the Commission to come up with an action plan and specific mechanisms to carry out an effective, realistic, affordable, and politically acceptable long term approach to improve teaching in mathematics and science. One recommendation is the development of a single, national standard for the certification of teachers in mathematics and science.

Another recommendation in the report requires local schools to hire only teachers who meet the certification requirement and that the federal government provides extra money to districts that voluntarily adopt the standards. An issue the report identifies is the critical problem of mathematics and science professors discouraging students from becoming schoolteachers and expecting them to become scientists. It has been suggested that a sustained national advertising campaign to attract science majors is needed (Brainard, 2007a; 2007b).

The NSES, *How People Learn*, and NCPTS have similar standards and suggestions for teaching, which may improve student achievement and hopefully provide the skills necessary for life in the 21st century. Over a 10 year span the *National Science Education Standards* published in 1996, *How People Learn* published in 2000, and *North Carolina Professional Teaching Standards* published in 2006 have identified exemplary teaching characteristics. The NSES identify the need for everyone to be able to use scientific information, so they can make choices in everyday life, engage in public discourse, and debate issues that involve science and technology (National Research Council, 1996).

On March 10, 2010, a panel of educators convened by the nation's governors and state school superintendents proposed establishing National Education Standards from kindergarten to high school graduation (Dillon, 2010). The United States Chamber of Commerce, the American Federation of Teachers, the National Association of State Boards of Education, Council of the Great City Schools, and other businesses and education groups immediately endorsed the draft of National Standards (Blackburn & Bruce, 2010; Dillon, 2010). The NC State Board of Education adopted the Common Core State Standards, making

NC one of the first states to embrace clear and consistent goals for learning. These Standards will be in place for the school year 2010-2011 (North Carolina Department of Public Instruction, 2010b).

Discrepancies between Envisioned and Reported

Lewis (2006) also reports both math and science professional communities who helped write the NSES have decided they tried to cover too much, and more emphasis needs to be placed on inquiry based learning around fewer concepts. They have advocated lessening the content and adding a little more drill. The National Research Council's report acknowledges that the last 15 years of reform have not deepened students' understanding of scientific ideas or the ability to engage in science practices. A national survey of science and mathematics educators found the U.S. teaching force is not prepared for *National Standards* based teaching (Weiss, Banilower, McMahon, & Smith, 2001). Rodriguez (1997) refers to a "discourse of invisibility" in the NSES because it compromises the well-intended goals, and fails to address the ethnic, socioeconomic, gender, and theoretical issues, which influence the teaching and learning of science.

The NCPTS establish the criteria and expectation for a model of teaching and learning in NC. Although these standards are grounded in the best practices found in the research literature a review of the literature reveals some of the problems that may hinder the vision becoming a reality. In a national observation study by Banilower, Smith, Pasley, & Weiss (2006) they found only 14% of science lessons were exemplary and provided students an opportunity to learn important science concepts. The science content of the lessons was

accurate and developmentally appropriate, but the quality of teacher questioning, monitoring student understanding, and developing a conceptual understanding was inferior.

Professional Development

The attitude of the teacher and the professional development they receive influences how the NSES are implemented in the classroom. Supovitz and Turner (2000) found the most powerful influences for teachers' practices and culture of investigation are the teachers' content preparation and attitude toward reform. Teachers with more sympathetic attitudes toward reform used inquiry-based practices more than skeptical teachers. The deeper and longer the professional development was sustained and supported by the principal, the greater the influence on teachers' practices and culture of investigation. Teachers with less than 40 hours of professional development had more traditional practices. Supovitz and Turner found that 80 hours of training is needed to increase inquiry-based teaching practices and investigative classroom culture.

Kimble et al. (2006) found the need for teachers' professional development activities to reflect the elements of high-quality instruction if participants are expected to implement constructivist methods back in their classrooms. Staff development in the content area does not translate into quality classroom instruction. Teachers need to know how students think about concepts, which constructs they have developed within a group, or on their own, and how to alter misconceptions. Alouf and Bentley (2003) found summer Institutes for teachers, which modeled inquiry-based science helped improve student achievement. When teachers used an inquiry approach for instruction it increased student motivation and observable gains in student behaviors, even in a high-stakes testing environment. The teachers in this study

reported students were more receptive to learning when inquiry-based instruction was used in their classrooms. Inquiry is not just a replication of a lab experiment it is more closely associated with the constructivist perspective (Bentley, Ebert, & Ebert, 2000; Zion, Michalsky, & Mevarech, 2005). If we want to increase the competency, literacy, and skills of our students, our students must be increasingly exposed to inquiry-based classrooms (King, 2007).

Middle School and Elementary School Teachers

Johnson (2006) studied the barriers science teachers encountered when implementing the NSES in middle school. Although effective professional development was provided, science teachers still encountered technical, political, and cultural barriers to implementing the NSES. More administrative support is required for it to be successful. This study also reveals that if teachers' existing beliefs are not addressed, the best intended professional development will not succeed. In order for more traditional teachers to find the inherent strengths involved in this practice, they must talk about it, experience it, and have an opportunity to reinforce learning new things. Collaboration between teachers is an important factor for reform efforts; however, the use of personal time to meet during lunch, planning, or after school places additional stress on teachers (Herman et al., 2008; Johnson, 2006).

A study by Smith and Gess-Newsome (2004) found the universal inclusion of content related to the NSES and a clear linkage between course goals, activities, and assignments does not exist for elementary science methods courses. Students entering high school may not have the necessary prior knowledge and skills to be successful in high school science courses. The National Research Council, National Institute of Child Health and Human

Development, and the Merck Institute for Science Education contends children have the ability to learn more science in earlier grades. They suggest learning progressions of concepts be taught from grade to grade. Ironically, a recent survey by Public Agenda found 66% of principals and 59% of superintendents do not believe that math and science education is a problem for their schools or districts (Lewis, 2006).

NC Accountability Model and the School Report Card

The NC *School Report Card* (North Carolina Department of Public Instruction Accountability Services Division, 2008b) is available for all NC citizens to compare schools across the state. For the 2009-2010 school year, there are only 11 elementary schools with 41% or higher economically-disadvantaged students that received the distinction for Honors Schools of Excellence. Seven of these schools are in the western region of the state, which has less racial diversity. Only four middle schools received this distinction, and they are located in communities that have elementary schools with this distinction. There are no high schools with 41% or higher economically-disadvantaged students that received this distinction. More schools receive this distinction if their school has less than 41% economically-disadvantaged students (North Carolina Department of Public Instruction Accountability Services Division, 2009). Geelan (2004) identifies the need for further research to compare urban, rural, and suburban schools, as well as different socioeconomic schools.

Other discrepancies between the envisioned and reported include the tendency for teacher to depend on textbooks. Textbooks are conceived as a way to ensure standardization for what teachers taught (Yager, 2000). Chiappetta and Fillman (2007) analyzed five of the

most popular high school Biology textbooks and found they include the recommended national science education reforms initiated in the 1980s. Alberts (2009) blames the prevailing market forces have led to science textbook mediocrity. Because all 50 states established their own very different science standards, textbook companies are forced to produce books that can satisfy as many states as possible. The exploration of the world of living things has been reduced to the memorization of key terms. Wise (1996) recommends teachers use inquiry strategies as the predominant approach to science instruction in middle and secondary schools from a meta-analysis of analyzing teaching strategies.

Conceptual Framework

The conceptual framework for this study is drawn from the five standards of the North Carolina Professional Teaching Standards. The school year 2010-2011 is the first year of implementation and evaluation of teachers based on the NCPTS. The five standards will be used to frame this investigation of how teachers are using the NCPTS to improve teaching and learning.

- Teachers demonstrate leadership is the first standard; how do teachers lead in their classroom, school, and profession, advocate for schools and students, and demonstrate high ethical standards?
- Teachers establish a respectful environment for a diverse population of students is the second standard; how do teachers provide a positive environment and nurturing relationships with students?
- Teachers know the content they teach is the third standard; how do teachers align their instruction with the SCOS, demonstrate knowledge of the course content,

recognize the interconnectedness of content areas/disciplines, and make instruction relevant for students?

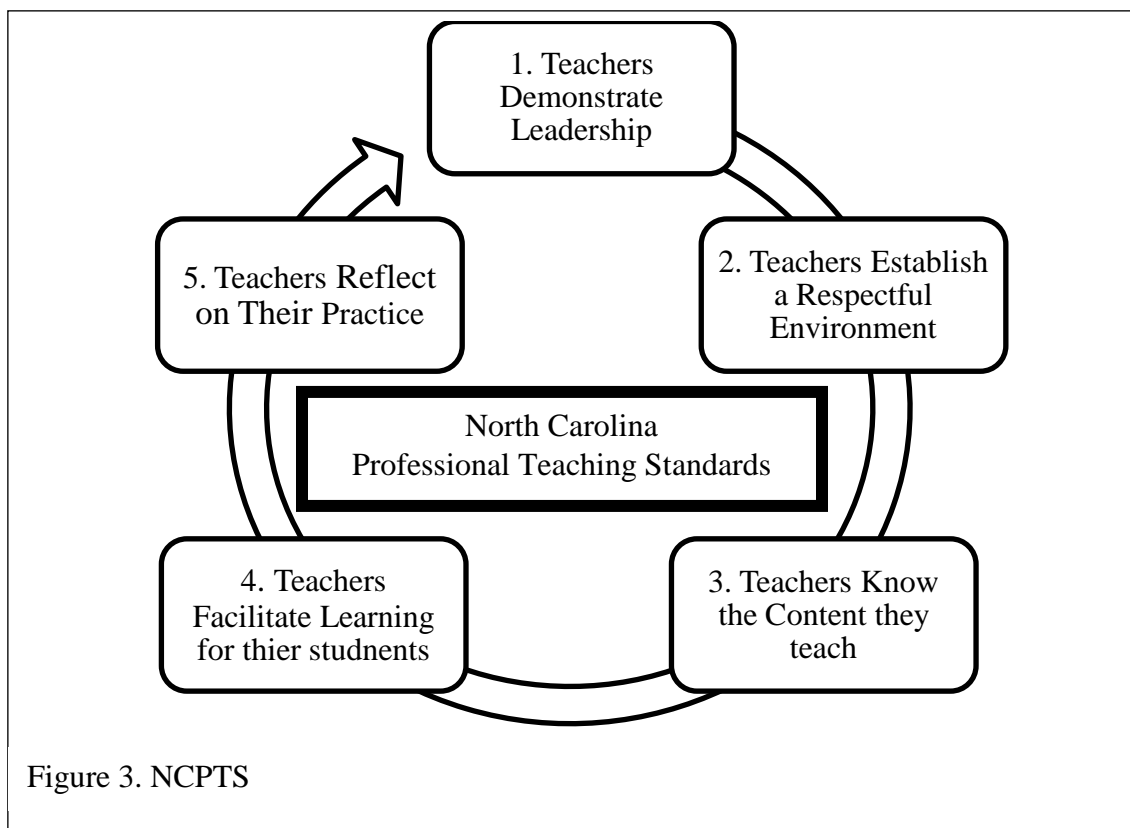
- Teachers facilitate learning for their students is the fourth standard; how do teachers demonstrate knowledge of how learning occurs and know the appropriate levels of intellectual, physical, social, and emotional development of their students? In what ways do teachers plan appropriate instruction, use a variety of instructional methods, integrate and utilize technology, help students develop critical thinking and problem solving skills, help students work in teams and develop leadership opportunities, use a variety of assessment methods, and communicate effectively?
- Teachers reflect on their practice is the fifth standard; in what ways do teachers analyze student learning, link professional growth, and function effectively in a complex, dynamic environment?

The rationale for asking these questions lies in the expectation that all NC teachers will demonstrate these standards effectively. A scoring rubric and examples of artifacts are provided in the North Carolina Professional Teaching Standards Evaluation Process (North Carolina Professional Teaching Standards, 2008d). The rating for each standard will be based on the lowest rating for each standard descriptor. Teachers have one year to improve their performance for any standard, which is designated as developing. This study investigates Biology teachers' perceptions of the NCPTS in a high stakes testing environment. Although these standards are grounded in the research for best practices, will the NCPTS be useful in guiding teachers to become exemplary practitioners?

Exemplary science teachers share common characteristics with all accomplished teachers. However, science teachers also have the responsibility of building inquiry into their lessons. This challenges science teachers to help their students understand the nature of science, which may lead to new discoveries. Inquiry is essential to the study of science so our students will be informed citizens and understand its importance for our society. Penick and Yager (1983) searched nationally for excellence in science teaching, and more recently, *How People Learn* identified the necessary principles required for learning. Additionally, Science teachers have the NSES, which is embedded in the requirements for National Board Certification in Science and shares common themes with the NCPTS. The NCPTS are anchored in the research of best practices and offer the opportunity for all NC teachers to reach capacity as educators.

A phenomenological study “describes the meaning of the lived experience for several individuals about a concept or phenomenon” (Creswell, 1998, p. 51). McPhail (1995) defines phenomenology as a method that concentrates on a phenomenon, which distinguishes it from other methodological approaches. There are three tenets of phenomenology, the first is consciousness, which includes; imagination, remembrance, perceptions, and logical forms or how the phenomenon is understood. The second assumption is that consciousness is always constituted in a reality that is not isolated from the experiential world. And the third assumption is each consciousness carries the lived experiences of the past within it as well as the anticipation of the future (McPhail, 1995). These Biology teachers have a shared lived experience of being the first to implement and be evaluated with the NCPTS. This phenomenon along with the existing research of best practices for exemplary science

teaching supports the five standards in the NCPTS as the conceptual framework for this study (see Figure 3).



Summary

This study acknowledges the search for excellence in science teaching by Penick and Bonnstetter (1993) and Yager (2000), as well as the work of others who have made contributions to research in science education. Several national documents identified the need for science education reform including: *A Nation at Risk* (National Commission on Excellence in Education, 1983), *Science for All Americans* (American Association for the Advancement of Science [AAAS], 1989), *Benchmarks for Science Literacy* (American Association for the Advancement of Science/Project 2061, 1993), *Trends in International*

Mathematics and Science Study (TIMSS) (U.S. Department of Education, 2003), *National Science Education Standards (NSES)* (National Research Council, 1996) and *The Nation's Report Card* (U.S. Department of Education, 2005). With the publication of the NSES (National Research Council, 1996a), *How People Learn (Bransford et al., 2000)*, and science education research, we know what is required to be an exemplary science teacher.

North Carolina's NCPTS (North Carolina Professional Teaching Standards Commission, 2006) are being implemented when NC is experiencing rapid growth while many of the state's teachers are reaching retirement age and the teaching profession is experiencing a high rate of teacher attrition. At the same time, North Carolina's accountability model (North Carolina Department of Public Instruction Accountability Services Division, 2008c) and the No Child Left Behind Act (2001) puts additional stress on Biology teachers for their students to do well on the EOC.

A gap exists in our knowledge for teachers' perceptions of the NCPTS. Implementation of the NCPTS has only occurred over the last two years. This study seeks to understand high school Biology teachers' perceptions of the NCPTS. Due to the teacher shortage, many school districts have lateral entry teachers, and teacher retirement has left school districts with few veteran teachers. What are the perceptions of lateral entry, initially licensed, and career status high school Biology teachers? Do they perceive the NCPTS differently or will they have common concerns? Do high school Biology teachers accept the NCPTS as a tool to help them be successful? Do they use the NCPTS to become an exemplary teacher? How do high school Biology teachers use the NCPTS? Does the NCPTS represent an accurate representation of an exemplary teacher? Do Biology teachers view the

NCPTS as another obstacle to remain in the classroom? How do teachers cope with less than a satisfactory rating as a teacher? NCPTS has the potential to bring about reform in education based on best practices, and a subset of this reform includes science education. Do the NCPTS need to be improved? This study seeks to investigate high school Biology teachers' perceptions of the usefulness of the NCPTS as an instrument for teachers to become exemplary science teachers.

Chapter 3

Methodology

Introduction

This chapter presents the rationale for using a qualitative research design from the phenomenological perspective. The specific components of this research study, including participant selection, data collection process, and data analysis are discussed. The trustworthiness of the research is also addressed. Accountability for educators continues to be a driving force for the improvement of teaching and learning in NC and the nation. North Carolina continues to implement policies and practices intended to improve education. The North Carolina Professional Teaching Standards (NCPTS) and the North Carolina Teacher Evaluation Process are among the most-recent efforts to facilitate improvement. Thirteen NC LEAs began using the NCPTS and its evaluation process for the 2008-2009 school year. The NCPTS provide a framework for teacher preparation, teacher evaluation, and serve as a guide for the professional development of NC teachers (North Carolina Professional Teaching Standards Commission, 2009a).

This study investigated high school Biology teachers' perceptions of the NCPTS to improve their teaching and student learning in a high-stakes testing environment. Each standard identifies the necessary indicators and teacher qualities for teaching in North Carolina. There are five standards: being a leader, providing a safe and respectful environment, knowing the subject content, facilitating opportunities to learn, and being

reflective. These are the ideal attributes, which are believed to be essential for teaching in the 21st century (North Carolina Professional Teaching Standards Commission, 2009b).

Research Questions

The focus of this study investigates high school Biology teachers' perceptions of the usefulness of the NCPTS to improve teaching and learning. North Carolina Biology teachers have the additional burden of an End of Course Exam (EOC). The EOC is a measure for the accountability model for the state and NCLB for the federal government. The NCPTS provides teachers with an appropriate set of teaching standards to guide instruction and professional development. As a result, the primary research question is: What are high school Biology teachers' perceptions of the NCPTS as a tool to improve their teaching and student learning in a high-stakes testing environment? This study also compared and contrasted the responses from teachers with three levels of NC teacher licensure. The secondary research questions are:

1. How do Biology teachers perceive the need to improve teaching and learning?
2. How do Biology teachers use the NCPTS to guide teaching and learning?
3. Which leadership opportunities are Biology teachers aware of and involved with?
4. How do Biology teachers establish a respectful environment for a diverse population?
5. Which curriculum and instruction resources are available and being used?
6. How do Biology teachers make instruction relevant for students?
7. How are Biology teachers assessing student learning?
8. How do Biology teachers use the NCPTS to guide their professional development?

9. How and what resources do Biology teachers use to reflect upon their practice?

Rationale for a Phenomenological Study

A phenomenological study is a qualitative research approach that can provide rich insight into human behavior (Guba & Lincoln, 1994). Humans use narratives to tell the story of ourselves and others (Lincoln, 2005). Phenomenology accepts the view that humans experience the world as we live, instead of a fixed set of existing rules for everyone. The researcher seeks to know more about the lived experiences of individuals regarding a phenomenon and the meaning they make of those experiences (Vagle, 2006). Teaching is highly idiosyncratic, complex, and multidimensional, which illustrates the need for a research method that will allow theory and themes to emerge from the data (Barnett & Hodson, 2001; Beeth & Hewson, 1999; Laplante, 1997; Lundeberg & Fawver, 1994; Polman & Pea, 2001; Roseberry & Puttick, 1998; Smith, 2005; Tobin & Fraser, 1990; Varrella, 2000). This research investigated the context of teachers' experiences with the phenomena of using the NCPTS in a high-stakes testing environment.

Phenomenology is a philosophical perspective as well as a qualitative methodology (Patton, 2002; Trochim, 2010). Historically based on the original work of Husserl (1990), phenomenology emphasizes a focus on people's subjective experiences and interpretations of the world. This places a person's experience at the center of the investigation.

Phenomenology can be applied to single or selected cases. Phenomenological research provides an opportunity for the researcher to seek personal and deep meaning from those that are being studied. This requires the researcher to acknowledge researcher influence and

involvement in the research process. It also requires the researcher to engage in personal reflection, contemplation, intuition, and insight into the self and others (Schmidt, 2005).

Phenomenology is “the first method of knowledge because it begins with things themselves” and attempts to eliminate prejudgments, customs, and beliefs to see in an “unfettered way” (Moustakas, 1994, p. 41). This emphasis on the human experience can provide an important tool for teachers’ self-reflection (Levering, 2006; Ostergaard, Dahlin, & Hugo, 2008). This methodology is appropriately aligned with this investigation because Standard 5 of the NCPTS is “Teachers reflect on their practice,” (North Carolina Professional Teaching Standards Commission, 2006).

In phenomenological research the researcher has a particular interest in the research question (Moustakas, 1994). Accordingly, the researcher seeks personal and deep meaning from those being studied. The phenomenological tradition does not provide a set of rules and procedures, but there are techniques, which have been consistently used for this approach. It requires the researcher to identify their predispositions and preconceptions, and be open to what others say, not what we want to hear. It builds on the need to construct shared meaning through reflective praxis and perception. The researcher also acknowledges their influence and involvement in the research process (Budd, 2005; Schmidt, 2005).

Moustakas (1994) identified four important principles of phenomenological research: epoche, reduction, imaginative variation, and synthesis. Epoche are the first person reports of life experiences. Reduction is describing what you see externally or internally, and the relationship between the phenomenon and self. The reduction comes from describing the phenomenon repeatedly, which provides unlimited opportunities of reflection. Imaginative

variation or varying the frames of reference and perspectives provides the researcher opportunities to derive structural themes. The final principle is the synthesis of meanings or the final truth.

Role of Researcher

The balance between the researched and the researcher in phenomenology is an understanding that the story is up to the subject, and the analysis and theorizing are up to the researcher (Levering, 2006). The data collection and analysis cannot be based on the personal desires of the researcher. A careful assessment of the implications for the methods and conclusions are essential components of phenomenological research. In order to create an unbiased study, the data collection and analysis needs to be clear of the researcher's personal assumptions. A careful assessment of the implications for the methods and conclusions are also essential components of this type of research.

It is important to recognize how these implications can influence the research. Although it is impossible to exclude them, the researcher can be aware of them. Being aware of these implications and how they may shape the research provide the opportunity to deal with their influence. Recognizing my personal ties to the study can provide a valuable source of insight, theory, and data about the phenomena being studied (Maxwell, 2005, p. 18-19).

As the researcher it is my goal to disclose what I believe about exemplary science teaching and my role as a High School Science Instructional Facilitator with the North Carolina Department of Public Instruction. By doing this, I believe I was in a better position to approach the topic openly and honestly. This acknowledgement, along with member

checks of the data, email exchanges with participants, and my research journal helped to filter my own experiences.

These efforts helped me be aware of the potential judgments that may occur during data collection, and analysis based on my belief system instead of the actual data collected from participants. Writing out what I believe before conducting the study gave me a frame of reference. I kept a journal with note cards during the time I collected data, I believe this helped me keep an open mind, differentiate between my thoughts and the participants' thoughts, and understand my own lens of viewing the world. Reading and rereading the data to find participants recurring words and phrases helped keep the focus on what the data revealed without prejudice or bias.

Researcher Identity

Teacher I. The prior experiences that are relevant to my research of understanding how high school Biology teachers perceive the usefulness North Carolina Professional Teaching Standards come from my experience as a high school Biology teacher for 27 years, assistant principal for two years, and grades 6-12 Science Instructional Coach with the North Carolina Department of Public Instruction for the last three and a half years. I have a B.S. and M.A.Ed. in Biology, and 30 hours of graduate credit in Biology past the master's degree.

I have taught in rural and urban high schools, low and high wealth high schools, and schools with various racial percentages. I am a National Board Certified teacher for Science, Adolescence and Young Adulthood. At the college level, I have taught Microbiology, General Biology, General Biology Laboratory, Botany Laboratory, Advanced Placement Biology, and Elementary Science Education Laboratory. I served as a supervising teacher for

14 student teachers, numerous interns prior to student teaching, and 10 years as a mentor for beginning teachers. I also worked closely with a professor of secondary science methods and his students prior to accepting my present position.

I was a member of the Public School Partnership Coordinating Council, Science Focus Group/Professional Learning Community, and Professional Development School Committee with the local university. I also serve on the Advisory Board for the Math and Science Education Center. I provided professional development across the state for Applied Biology/Chemistry, which is a science course developed by the Center for Research and Occupational Development. This curriculum emphasizes cooperative learning, hands-on activities, laboratories, and relevance for student engagement. I served as a committee chair, school chair, and visiting committee member for Secondary Schools and Colleges Accreditation. I also serve on Comprehensive Needs Assessment committees for NCDPI, to evaluate the strengths and areas to improve low performing school in North Carolina. These experiences provided opportunities for leadership and professional growth.

Administrator and Instructional Facilitator I. For the last two and half years of my teaching career, I served as an assistant principal and was trained to use the Revised Teacher Performance Appraisal Instrument to evaluate teachers prior to the state's implementation of the NCPTS. In my present role as a High School Science Instructional Coach, I assist career status, initially licensed, and lateral entry science teachers improve their practice. My task is to help teachers reach capacity by providing strategies and resources for teaching and learning. I have been involved with various aspects of the Biology End of Course test, Biology Standard Course of Study and Biology Support Documents. I wrote, edited, and

reviewed the Biology EOC questions and test versions, and matched the Biology EOC questions to the SCOS for a NCLB audit. These experiences have provided an opportunity to understand the pressure to teach inquiry, remain focused on the curriculum, and have my students tested in comparison to the average state scores for Biology. Literacy is an issue in the low-performing schools I serve, my experiences teaching remedial reading and math with ESAA, graduate assistantship for literacy and adult education, and teaching inclusion Biology for Exceptional Children have provided experiences in public education in addition to teaching high school Biology.

My own experiences of meeting the standards I. My assumptions and experiences are supportive of the NCPTS. My career spans enough time that I can reflect on my experiences for each standard. I believe each standard is grounded in best practices and research. I did not have the advantage of having these standards at the beginning of my career. Instead, I experienced each of these standards through my own inquiry, professional development, and pursuit of National Board certification. From my review of the literature, personal, as well as professional experience, I believe the NCPTS are an accurate description of the characteristics of an exemplary teacher. In my role as a High School Science Instructional Coach with the North Carolina Department of Public Instruction, I have had professional develop opportunities, which have helped deepen my understanding of the NCPS. Part of my work involves assisting science teachers with implementing each of the NCPTS.

My questions and concerns for the implementation of the standards are based upon my own experiences as a teacher and instructional coach. The teachers I serve often complain

that they do not have enough time to plan because they have meetings and professional developments to attend during their planning periods. They are also frustrated with the high attrition rates of administrators and science teachers. An administrative change brings a new vision before they could see an impact for the one it replaced. How are teachers coping with the NCPTS that are being used to evaluate their teaching? Will teachers perceive the lack of time to study and understand the standards as an excuse for a poor lesson? Is it realistic to expect teachers to be proficient at each of these standards? How are initially licensed teachers using the NCPTS as a guide for teaching and coping with the demands of teaching from day to day? How are lateral entry teachers coping with this and the additional stress of completing the requirements for certification? How will the designation of being identified as a developing teacher impact a teacher's view of the standards and their dedication to being a teacher?

My own experiences, assumptions, and goals shaped my decision to choose this topic. I am not convinced that it is reasonable to expect inexperienced and unlicensed teachers to have the same competence as a veteran teacher who has had more time to understand the complexities of teaching and application of these standards. Would the three groups of teachers have similar or dissimilar views and experience using the NCPTS? I also wondered if career status teachers are receptive to the NCPTS or feel this too shall pass, like many of the incentives NC has tried in the past.

As the population of NC continues to grow, and we continue to have a high teacher attrition rate and lack of highly qualified teachers, what effect does this have on the implementation of the NCPTS? Will the NCPTS remain in place as they are, be modified, or

change with a new policy? Are the standards a fair expectation and helpful for teachers or too much to ask for? Are the standards being implemented fairly from school to school?

My goals, beliefs, and experiences provide me with a teacher's frame of reference. Listening to teachers' stories provided an opportunity for common themes and possible theory to emerge from the data. My understanding of each of the NCPTS enabled me to ask appropriate questions about Biology teachers' perceptions of the NCPTS. My experience enables me to understand the impact each standard has on teaching and learning. It also helps me understand the impact of professional development and growth of teachers. It enables me to understand the perspectives of career status, initially licensed, and lateral entry teachers. My experiences as a teacher, administrator, and instructional coach enabled me to draw conclusions about the success, needs, and/or failure of the NCPTS, which may help our teachers reach capacity and achieve the vision of teaching and learning in NC.

The potential disadvantages of my goals beliefs and experiences are the fact that I understand the importance of each of the standards and how it relates to student achievement. My support of the NCPTS could be a hindrance for me to understand teachers' perceptions. The teachers I interviewed may be unable to separate the need to improve from accepting their own deficiencies. A potential disadvantage could be a teacher's refusal to accept feedback for an evaluation that is less than they expected and encountering their defensiveness toward the evaluation instead of looking at it as a way to identify weaknesses and use the opportunity to grow in the profession. My experience in low-performing schools in comparison to adequate or high performing schools may influence my expectations of what teachers could be doing to help students achieve.

Researcher Status

Naturalists are aware of the sources of difficulty in using humans as instruments and respondents as the source of the data (Lincoln & Guba, 1985). Humans get tired, exhibit selective perception, cannot control all vantage points, and have limited perspectives. There is a system of useful checks and balances, including: member checks, debriefings by peers, triangulation of data, prolonged engagement and persistent observation, reflexive journals and an independent audit (Lincoln & Guba, 1985). As a researcher my approach is an awareness of my subjectivities as I search for meaning of teachers' perceptions and experiences of being evaluated with the NCPTS. One of the challenges for the phenomenologist is the need to know enough about the phenomenon of interest to have the credibility and the perceptivity to study it properly (Vagle, 2006).

Triangulation of the data is often used to indicate more than two methods are used to study the results of the investigation. This provides more confidence in the data if different methods lead to the same results. Triangulation reduces the risk that the conclusions reflect systematic biases, a specific source or method and allows the researcher to gain a broader and more secure understanding of the research being conducted (Maxwell, 2005). Using three methods to answer one question that produce similar answers increases the credibility and validity of the analysis and conclusions. Triangulation involves using multiple data sources in an investigation to aid the researcher's understanding of the data. Analyst triangulation of the data utilizes multiple sources, including; reading and rereading the interview transcripts to search for themes, creating cross case displays, and providing opportunities for member checks.

To attend to the participant's descriptions and keep my understandings and assumptions from having an influence on the phenomenon, I have identified my own experiences as a teacher, administrator, and science instructional coach. I kept a research journal prior to and during data collection and throughout the data analysis (Glesne, 2006). Participants were invited to use email for additional comments and suggestions. The interviews were recorded and transcribed along with member checks to ensure accuracy and intentions of the data. Each line of the transcripts was numbered for cross referencing participants' responses. The data was read and reread to provide opportunities for common themes to emerge from the data. This acknowledgement of the limitations of being able to set aside my biases, assumptions, and understandings enable me to be disciplined about how these biases, assumptions, and understandings, which may have influenced the data collection and analysis (Vagle, 2006).

Ethical Issues

Phenomenological research typically uses interviews (Creswell, 1998). Research relationships are "asymmetrical, with the power disproportionately located on the side of the researcher" (Glesne, 2006, p. 138). This requires the researcher to consciously consider and protect the rights of participants to privacy. Ethical considerations included: informed consent, protecting participants' anonymity, and the use of fictitious names (Glesne, 2006; Marshall & Rossman, 2006). Another characteristic of good qualitative study is the sensitivity to the risks of human subjects (Stake, 1995).

Stake (1995) advocates that the researcher should indicate how and why the organization was selected. To protect the participants, the school or school system is not

identified other than one of the LEAs that piloted the implementation of the NCPTS.

Participants had the right to make informed decisions about participating in the study and withdraw from the study at any time (Creswell, 1998; Glesne, 2006; Patton, 2002;). This research was feasible and ethical, and participants' time was voluntary and not harmful.

This study was approved by the Appalachian State University Institutional Review Board (see Appendix 1). The rights of participants for this study were protected in the following ways. Participants in Schools involved with Phase 1 implementation of the NCPTS received an email with an invitation to participate (see Appendix 2). When an inadequate number of initially licensed and lateral entry teachers from Phase I school systems were not available, participants from Phase II school systems were also invited to participate in the study. Participants received an introduction to the study and their role in the process verbally and in writing. Teachers were asked to sign a written consent form detailing their participation and ability to withdraw from the study at any time (see Appendix 3). Teachers received a lay summary of my background and interest in conducting the study (see Appendix 4). Participants received a copy of the interview protocol and copy of interview questions (see Appendix 5). Participants are identified with a fictitious name for the interview recording, transcription, and presentation of results to ensure their anonymity.

Data Sources

This study seeks to understand North Carolina High School Biology teachers' perceptions of the NCPTS to improve teaching and learning. The sampling for this study was "maximum purposeful sampling," which selects information-rich cases strategically and purposefully (Patton, 2002). Qualitative inquiry focuses on in-depth interviews with

relatively small samples (Patton, 2002). This study focused on 12 high school Biology teachers.

There are three pathways of entering the teaching profession in North Carolina. A teacher with a continuing license has met certification requirements and taught successfully in North Carolina for at least four years. A beginning teacher with an initial license has fulfilled the appropriate teacher education requirements, but lacks experience. Finally, due to the teacher shortage, a teacher may be hired by a school system that lacks a highly qualified teacher. This teacher has a college degree but lacks teacher education preparation. Regardless of the type of license, all teachers in North Carolina have the NCPTS to guide their teaching and will be evaluated accordingly with these standards. Twelve teachers, four from each of the three levels of licensure were selected and interviewed for this study.

Teachers employed in Phase I school districts were chosen first because they have been involved with implementing the NCPTS for last two years. Additionally, two initially licensed and two lateral entry teachers employed in school districts in Phase II were selected to complete 12 interviews. Reflection is one of the NCPTS, and these teachers have had more time to use the standards as they reflect upon their practice.

Teachers update their Individual Growth Plan (IGP) each year, which is a requirement to keep a teaching license (North Carolina Department of Public Instruction Accountability Services Division, 2008c). Teachers along with their administrator determine the focus of their professional development, which will be based on the NCPTS for the first time. This study includes four career status, four initially licensed, and four lateral-entry teachers, which represent the general population of Biology teachers across the state. This

provides a wide range of cases for variations to emerge from adapting to these three different conditions. This also served to identify common patterns that cut across these variations of teachers using the NCPTS (Patton, 2002). This study sought to understand their perceptions and experiences, especially in light of the teacher shortage in North Carolina due to its rapid population growth, low number of college graduates entering the teaching profession, and teacher attrition. Participants were not selected or eliminated based on their gender, race, or ethnicity. Participants volunteered for this study, and they did not receive any compensation from the researcher.

Data Collection

I conducted interviews that explored these teachers' perceptions of the usefulness of the NCPTS in helping them be an exemplary science teacher. The interview lasted 60 to 90 minutes, and took place at a time and location most suited to the needs of the participants. School districts involved in the Phase I implementation of the NCPTS, and closest proximity to the university I am affiliated with were used for this study. Initially licensed and lateral entry teachers from Phase II were invited to participate when there were not enough participants from Phase I. School web pages were used to identify potential participants. Biology teachers received an email inviting them to participate in the study. Biology teachers who responded to the invitation were emailed additional information and a request to schedule an interview. Participants had the opportunities to choose a time and place that were convenient for them.

All participants received a copy of the informed consent form and a copy of the lay summary. Participants were told their responses would remain anonymous, and fictitious

names were assigned to facilitate analysis of the data. Participants could withdraw from the study at any time before, during, or after the interview. Interviews were recorded with a digital recorder to prevent loss of data and review of the data for analysis. The recording was used to construct a written transcript of each interview. Each transcript was printed on a different color of paper for coding and analysis. The transcripts were printed again with numbered lines and reread to facilitate the coding and analysis of emergent themes.

Participants

Voluntary participation was sought from Biology teachers in seven of the 13 schools districts that began implementing the NCPTS in Phase 1. Email addresses or contact information was obtained from the high schools' web pages. Initially licensed and lateral entry teachers are evaluated with the Teacher Evaluation Process each year. Career status teachers are evaluated when their license must be renewed every five years. The area near the university where this study took place has not experienced the shortage of science teachers, which has occurred in the urban and eastern region of the state. This limited the pool size of participants. Eight of the 12 participants were involved in Phase 1. Four participants were selected from Phase 2 schools to complete the selection of 12 participants. Since these four participants are not career status teachers, and they have less experience, the year the school implemented the NCPTS and Teacher Evaluation Process had little to no effect on these participants.

The National Center for Education Statistics (2011) (NCES) developed locale codes, which are used to describe a school's location ranging from rural to large city. The NCES identifies these codes that match the physical location along with the geographic database

maintained by the Census Bureau. The locale codes are based on an address's proximity to an urbanized area and classify the territory into four major types: city, suburban, town, and rural. Cities and suburban's have gradations of large, midsize, and small. Towns and rural areas are distinguished by their distance from an urbanized area and characterized as fringe, distant, or remote. Participants from midsize city, midsize suburban, rural fringe, and rural distant designation were interviewed for this investigation. No one was included or excluded from the study based on the NCES codes. This information is pertinent to understanding the data.

One participant teaches in a mid-size city. This is an urbanized area with a population less than 250,000 and greater than or equal to 100,000. Two participants teach in schools that are in a mid-size suburb. This is a territory outside a principal city, and inside an urbanized area with the population less than 250,000 and greater or equal to 100,000. Seven participants teach in schools that are rural fringe communities. This is a rural territory that is less than or equal to five miles from an urbanized area, or a rural territory less than or equal to 2.5 miles from an urban cluster. When the core contains a population of 50,000 or more, it is designated as an urbanized area. Core areas with populations between 25,000 and 50,000 are classified as urban clusters. Two of the participants are in a rural distant community that is more than 6 miles, but less than or equal to 25 miles from an urbanized area, or a rural territory that is more than 2.5 miles, but less than or equal to 10 miles from an urban cluster (National Center for Education Statistics, 2011).

Interview Protocol

Qualitative researchers seek out respondents at their own home, workplace, or any other setting preferred by respondents and focus on events and experiences (Padgett, 1998). Participants selected a time and place that were convenient for them. Email addresses available on the school web site were used to solicit participation. The invitation email identified the purpose of the study, which sought to interview high school Biology teachers about their perceptions of the NCPTS to improve teaching and learning. Participant selection was initially limited to school districts involved in the Phase I implementation of the standards, with additional participants selected from Phase II. A follow up email provided teachers with the informed consent form, and the assurance of anonymity of themselves, their school, and their school district throughout the collection and reporting of the data. At the beginning of each interview, participants were again provided with the purpose of the study, informed consent, assurance of anonymity, lay summary and university contact information.

The purpose of the interview questions (see Appendix 5) was to elicit the Biology teachers' perceptions and experiences of using the NCPTS to guide teaching and learning. Understanding these perceptions may be useful feedback for the NCPTS Commission and school administrators. Participants were asked to confirm their licensure status to ensure maximum purposeful sampling. Confidentiality is protected throughout the study for their name, school, and school district. The interview transcripts were offered to participants for verification to ensure the information in the data is correct. Participants had the right to withdraw from participating in the study before, during, and after the data collection. Participants received a copy of the questions.

The questions were developed from each of the five strands listed in the NCPTS. The first questions identify the licensure of each participant for coding purposes. The questions serve as an interview guide, and help ensure that the same questions are asked of each participant (Patton, 2002). Probing questions were used to elicit participants' responses further as needed.

Data Coding and Data Analysis

Data analysis in qualitative research depends on an investigator's own style of rigorous thinking, sufficient evidence, and careful considerations of alternative interpretations (Yin, 2003). In phenomenological research, analysis is made through reflection and insightful meaning making (Budd, 2005; Maxwell, 2005; Miles & Hauberman, 1994; Moustakas, 1994; Sharma-Brymer & Fox, 2008). Giorgi (1985) provides a guide for phenomenological analysis, which includes: gaining a sense of the whole by reading and rereading the transcripts, identifying meaning units, categorizing meaning units into themes, and synthesizing themes into a statement about the issue being studied. Detailed data coding of the interviews assists the organization of the data (Giorgi, 1985; Miles & Hauberman, 1994).

The interview transcripts were read and reread to search for emerging themes within and across the interviews. Repeated phrases were placed in tables for each interview to facilitate organization. Numbered lines and pages were also used to identify and reread the interview data. This method assisted the progress of identify themes and sub-themes. Additionally, each interview transcript was printed on different colors of paper and then separated an organized accordingly to their response. Participants' responses to each of the

interview questions were grouped by question for cross-case analysis (Miles & Hauberman, 1994). Generalization is not the goal of qualitative research (Denzin, 1996; Lincoln & Guba, 1985) but, the data may be relevant or applicable to other similar settings. Cross-case analysis also deepens understanding and explanation through examination of similarities and differences across cases, which helps to support of the development of theory (Miles & Hauberman, 1994).

Trustworthiness

The credibility issue for qualitative inquiry depends on three related elements, which include rigorous techniques and methods for gathering high-quality data that is carefully analyzed and attention given to validity, reliability, and triangulation (Patton, 1999). The validity of this study is based on the foundation of the five standards, which served as the guiding questions and conceptual framework for this study. The reliability of this study is based on the accuracy of participant selection, adequate time for the interview, record of responses for each interview, completeness of the transcribed data, and the ability of subsequent research to yield the same results. The validity and reliability was not compromised during or after the study. Each of the interviews followed the same protocol. Triangulation of the data sources provides an opportunity to cross check the consistency of information derived from the interviews. This supports the idea that there is no single method that adequately solves the problem of rival explanations. Qualitative analysis allows the use of multiple theoretical perspectives, which may emerge from analysis of the data.

Qualitative analysis depends on the researcher's pattern recognition, creative insight, systematic approach, and ability to be analytically rigorous (Giorgi, 1985; Lincoln & Guba,

1985; Patton, 1999; Yin, 2003). The qualitative researcher has an obligation to report enough details and the process of analysis for others to judge the quality of the research. It is important to look for competing themes and explanations. This can be done by looking for alternative ways of organizing the data and thinking about other logical possibilities supported by the data.

The participant's data were collected a place they selected. Nine participants chose to be interviewed in their classrooms and three interviews were conducted off campus at a coffee shop or book store. Participants were informed how they were selected, that their name, school, and school system name would not be identified other than as one of the LEAs that piloted the NCPTS. The informed consent form was provided along with an explanation that they could withdraw from the study at any time. The identities of each of the participants have been protected with fictitious names, and careful examination of the data has maintained its reliability.

Summary

In summary, data collection included individual interviews with twelve high school Biology teachers from school systems involved with the Phase I and II implementation of the NCPTS. Four career status, four initially licensed, and four lateral entry high school Biology teachers were selected for the interviews. Data was collected with digital audio, and written field notes during the interview. Emails were used for teachers to make additional comments about their perceptions and clarifying information for the researcher. A reflective journal was kept by the researcher to help identify my own bias and to help ensure objectivity. The

researcher transcribed the interviews verbatim, and the transcripts were offered for participants to check for accuracy and intention.

Chapter 4

Results

The phenomenological study was conducted to examine high school Biology teachers' perceptions of the usefulness of the North Carolina Professional Teaching Standard to improve teaching and learning in a high-stakes testing environment. Included in this study is an exploration of how high school Biology teachers are using each of the standards with students in their classroom, and the amount of professional development they received prior to the implementation of the NCPTS and the Teacher Evaluation Process. Implications for achieving the desired effect on teaching and learning were also identified.

Research Questions

The primary research question is: What are high school Biology teachers' perceptions of the NCPTS as a tool to improve their teaching and student learning in a high-stakes testing environment? The secondary questions include:

1. How do Biology teachers perceive the need to improve teaching and learning?
2. How do Biology teachers use the NCPTS to guide teaching and learning?
3. Which leadership opportunities are Biology teachers aware of and involved with?
4. How do Biology teachers establish a respectful environment for a diverse population?
5. Which curriculum and instruction resources are available and being used?
6. How do Biology teachers make instruction relevant for students?

7. How are Biology teachers assessing student learning?
8. How do Biology teachers use the NCPTS to guide their professional development?
9. How and what resources do Biology teachers use to reflect upon their practice?

The findings focus on emergent themes that were gathered from the Biology teachers' interviews, reflective journal, emails, coding, and analysis of the data. The findings of this study are presented in three sections. The first section contains the demographic information of the high schools and school systems chosen for this study. The second section describes the Biology teacher interview procedure and introduces participant's responses with a focus on their perceptions of the need to improve teaching and learning, and their use of the NCPTS in their instructional practice. The third section discusses the themes, which emerged from the data. The last section displays cross-case responses to the secondary research questions. Fictitious names are used to protect the right to privacy of the research participants (Glesne, 2006).

The North Carolina Professional Teaching Standards were implemented over a three-year period beginning with the 2008-2009 school year. Thirteen school districts implemented the NCPTS and Teacher Evaluation Process in Phase I. Two of the Phase I school districts have only one Biology teacher in the high school, which diminishes the right to privacy. The scarcity of initially licensed and lateral entry Biology teachers in the Phase I schools in the proximity of the University, created the need to seek four participants from school districts that implemented the NCPTS in Phase II. These participants' length of service would be the same for all districts, which means their perceptions of the NCPTS does not depend on when the school district implemented the use of the NCPTS and Teacher Evaluation Process.

Copies of the NCPTS and website information (North Carolina Professional Teaching Standards, 2008) were distributed to all teachers across the state during the school year for 2007-2008. Initially licensed and lateral entry teachers are evaluated each year until they reach career status or continuing licensure. Career status teachers are evaluated throughout the year of their license renewal cycle every five years. These standards are new to NC teachers, and this study sought the opportunity to listen to teacher voices about the phenomenon of having NC teaching standards and evaluation process based on the standards.

Urban, Suburban, and Rural Descriptions

The National Center for Education Statistics (2011) (NCES) developed locale codes, which are used to describe a school's location ranging from large city to rural. The NCES identifies these codes that match the physical location along with the geographic database maintained by the Census Bureau. The locale codes are based on an address's proximity to an urbanized area and classify the territory into four major types: city, suburban, town, and rural. City and suburban areas are further divided into large, midsize, and small gradations. Towns and rural areas are distinguished by their distance from an urbanized area and characterized as fringe, distant, or remote. One participant teaches in a school located in a mid-size city. Two participants teach in schools located in mid-size suburbs. Seven participants teach in schools that are identified as rural fringe communities. Two of the participants teach in schools that are located in rural distant communities (National Center for Education Statistics, 2011).

Midsized City Participant. Melinda is a Biology teacher at a health science and information technology academy with 142 students, which is part of the new-school initiative. These students can finish high school in three years and attend one or more years at the local community college free of charge. Melinda is a third year initially licensed teacher with a four-year degree in a school system that implemented the NCPTS and Teacher Evaluation Process in the Phase II cohort. The school has 14 teachers and receives Title 1 federal funds, which is the nation's oldest and largest federally funded program. These funds provide financial support to schools across the country for students at risk of failure and living at or near poverty. For a school to qualify for Title 1 funds, at least 40% of students must enroll in the free and reduced lunch program (U. S. Department of Education, 2011). Melinda's school has a minority student population of 73% (North Carolina Department of Public Instruction Accountability Services Division, 2008a). Melinda comes from a family of educators, which includes teachers, administrators, and school board members.

Midsized Suburban Participants. Jennifer is a third year lateral entry Biology and AP Biology teacher, in a school that is designated as Phase I implementation of the NCPTS. This is her third year as a teacher and her second year at this school. There are 700 students and 91% of its teachers are highly qualified. The school population is 60% White, 18% Black, 13% Hispanic, 6% Asian, and 3% unknown (Public School Review, 2011). The school does not receive Title 1 funding (North Carolina Department of Public Instruction Federal Program Monitoring, 2011).

Jennifer moved here from another state, which encourages teacher candidates to finish a four-year degree and then complete a master of teaching degree before they enter the

teaching profession. Since she didn't have the money to support herself for another year, she moved to NC to accept a position as a lateral entry teacher. Jennifer finished the requirements for licensure in a year from a NC public university, which she did online. Now she plans to leave the teaching profession to pursue a graduate degree in social work. She said, "My students tell me I should be a counselor, so I have lots of kids who come to me and spill their beans."

Keira was a nurse before she decided to enter the teaching profession as a lateral entry teacher. This is beginning her fifth year as a teacher. She moved to NC because she was ready for a career change. She could work in NC as a lateral entry teacher and take certification classes at the same time. The school has 120 students and now that Keira has finished her lateral entry certification, 100% of the teachers are highly qualified. The school population has 42% White, 25% Black, 6% Hispanic, and 27% Asian (Public School Review, 2011). The school does not receive Title 1 funding (North Carolina Department of Public Instruction Federal Program Monitoring, 2011). The school was involved in the implementation of the NCPTS and Teacher Evaluation Process as Phase I.

Rural Fringe Participants. Seven of the twelve participants teach in rural fringe schools. Only two of the twelve participants teach in the same school. Teresa and Stephanie were the first two teachers I interviewed. The school has 2000 students and 93% of the teachers are highly qualified (North Carolina Department of Public Instruction Accountability Division, 2008a). The school was built a few years ago in an area with new homes, stores, and restaurants. The school is in the southern section of the county that

neighbors another area of growth in the northern section of a county with a large city. The school system implemented the NCPTS and Teacher Evaluation process in Phase I.

Teresa is a career status teacher with National Board certification, and she has taught Biology for 29 years. Some of the other participants have either applied, not passed, or applied and they are waiting on the notification of National Board certification, which is announced in November each year. Teresa teaches in a school with a population of 91% White, 3% Black, 3% Hispanic, 2% Asian and 1% unknown; 7% of the students are eligible for free and reduced lunch. Teresa is the science department chair; she also serves as a mentor teacher, and the leader of the Biology professional learning community.

Stephanie is the second teacher I interviewed from this school. At first she wanted to clean her aquarium while we talked, but after we began the interview, she gave me her full attention. She moved here from another state to enter the teaching profession as a lateral entry teacher. After earning her Biology degree, she realized that she needed some type of certification or credentials other than a bachelor's degree in Biology to find employment. She considered entering various medical field programs, but all would have required her to return to school full-time. Stephanie said she "didn't have the money to go back to school full-time, and when I saw a television advertisement for lateral entry teachers, I decided to teach." She found a certification program she could do after work. She began teaching in a middle school in a neighboring school system, then as a high school science teacher in an urban school district before moving to her present position in the new school. Stephanie decided to add comprehensive science to her certification, and recently earned a master's degree program in Environmental Science. She said she may leave teaching if she could find a job in that field.

Alice is another participant who teaches in this same school district, which implemented the NCPTS in Phase I. This school is in an area identified as a rural fringe. The school has 900 students and 93% of its teachers are highly qualified. The school population is 77% White, 15% Black, 5% Hispanic, 2% Asian, and 1% unknown; 30% of the students are eligible for free and reduced lunch (Public School Review, 2011). The building was built 50 years ago, and a lot of the students were moved to the new larger school when it opened a few years ago, leaving this school with a less affluent population and fewer students. Alice wants the school to offer Advanced Placement Biology next year, and she is working to recruit students and gain administrative support. She shared her concern for the lack financial resources to provide lab activities for students.

Walt is a career status teacher in a school identified as rural fringe, and he has been teaching for 19 years. The school has 1,600 students and 96% of its teachers are highly qualified (North Carolina Department of Public Instruction Accountability Division, 2008a). The student population is 85% White, 6% Black, 4% Hispanic, 4% Asian and 1% unknown (Public School Review, 2011). The school does not receive Title 1 funding (North Carolina Department of Public Instruction Federal Program Monitoring, 2011). The school system implemented the NCPTS during Phase 1. Walt is actively involved in leadership opportunities with a university and public school partnership. He is willing to take risks with new curriculum materials to improve teaching and learning. He said during his interview that “You get the general feeling of what I think about something, I would even say what I think to the Superintendent.”

Grant teaches in a rural fringe high school with 1,200 students, and 97% of its teachers are highly qualified (North Carolina Department of Public Instruction Accountability Division, 2008a). The school population is 66% White, 26% Black, 5% Hispanic, and 2% unknown; 23% of the students are eligible for free and reduced lunch (Public School Review, 2011). The school system implemented the NCPTS and Teacher Evaluation Process in Phase I. The school is located near a large population area that is a desirable place to live and work, and 100 % of the teachers are highly qualified. After a tour of duty with the Air Force, Grant entered the profession as an ILT, and now he is a career status teacher with 11 years of experience. He will graduate in May with a degree in school administration.

Katie also teaches in a rural fringe high school with 1,400 students and 97% of its teachers are highly qualified (North Carolina Department of Public Instruction Accountability Division, 2008a). The school population is 95% White, 1% Black, 2% Hispanic, and 1% unknown; 18% of the students are eligible for free and reduced lunch (Public School Review, 2011). The school is in a community where teacher recruitment is not a problem. Katie is a third-year ILT in a school system that implemented the NCPTS and Teacher Evaluation Process in Phase II. Katie is currently completing a Master's Degree in Teaching from a university in a different state.

Karen teaches in a rural fringe high school with 800 students. Two of the science teachers in the department are from Teach for America. Some teachers leave the system after one year because their spouses cannot find jobs in the area. All of the science teachers at this school are young, and they enjoy working together. The NCPTS and Teacher Evaluation

were implemented in Phase II, 81% of the teachers are highly qualified (North Carolina Department of Public Instruction Accountability Division, 2008a). The student population is 29% White, 62% Black, 8% Hispanic, and 1% unknown (Public School Review, 2011). The school receives Title 1 funding (North Carolina Department of Public Instruction Federal Program Monitoring, 2011). Karen is a third year lateral entry teacher, and she is finishing licensure online at a public university. The teacher and her husband live in another county and travel in opposite directions to work. Karen is looking forward to finishing the requirement to teach in a Title 1 school so her college loans will be forgiven, and she can stay home and raise a family.

Rural Distant Participants. Sean teaches in a high school with 1,200 students and 96% of the teachers are highly qualified (North Carolina Department of Public Instruction Accountability Division, 2008a). The school system implemented the NCPTS and Teacher Evaluation Process in Phase I. Sean is a career status teacher with 19 years of experience. The school population is 80% White, 9% Black, 8% Hispanic, 2% Asian, and 1% unknown; 33% of the students are eligible for free and reduced lunch (Public School Review, 2011). He worked in the service industry before entering the teaching profession. His biggest complaint was his lack of knowledge and understanding of how to set up a laboratory experience for his students. He returned to the private college he attended and asked his former professors to teach him how to order supplies and equipment, how to set up and conduct science lab experiments and activities. Sean applied for National Board certification, but gave up after the second failure. He credits the lack of time to do all the paperwork for National Boards

because of the work he does with another job. He and his colleagues are considering a Master's degree in Biology program that is being offered online at a public state university.

Lacey is a first-year ILT. She completed her Biology degree and licensure requirements at a public university last spring. She drives an hour to and from work each day, from a neighboring county where she grew up. She expressed bitterness for not being hired to teach in another high school closer to where she lives. She said, "I want to be such a phenomenal teacher that they regret not hiring me." She teaches in a high school with 650 students, and 94% of its teachers are highly qualified. The school population is 94% White, 4% Hispanic, and 2% unknown; 40% of the students are eligible for free and reduced lunch (Public School Review, 2011). The school system implemented NCPTS and the Teacher Evaluation Process in Phase II.

Table 1 presents a graphic display of the demographic information for the participants in this study. The table includes the list of participants, teaching license as a career status with a continuing license, Initially Licensed Teacher, and Lateral Entry teachers without a certificate to teach. The table also identifies the type of community the schools are located, and which phase their school system implemented the North Carolina Professional Teaching Standard and Teacher Evaluation Process (see Table 1). Table 2 presents a graphic display of the chronological order of participant interviews, number of years' experience, school size, college degree, and School Biology EOC performance (see Table 2). Table 3 presents the percentage of low income students in each of the schools (see Table 3).

Table 1

Description of Participants

Participants	Licensure	School location	Phase	NBCT
Teresa	Career Status	Rural Fringe	Phase I	Yes, NBCT
Sean	Career Status	Rural Distant	Phase I	No, applied
Walt	Career Status	Rural Fringe	Phase I	No, applied
Grant	Career Status	Rural Fringe	Phase I	No
Alice	ILT	Rural Fringe	Phase I	No, applied
Lacey	ILT	Rural Fringe	Phase II	No
Katie	ILT	Rural Fringe	Phase II	No
Melinda	ILT	City Midsize	Phase II	No
Stephanie	Lateral Entry	Rural Fringe	Phase I	No, applied
Jennifer	Lateral Entry	Suburban Midsize	Phase I	No
Kiera	Lateral Entry	Suburban Midsize	Phase I	No, applied
Karen	Lateral Entry	Rural Fringe	Phase II	No

Table 2

The Chronological Order of Participant Interviews

Participants	Experience	Enrollment	Degree	2010 Bio. EOC St. Av. 81.2%
Teresa	29 years	@ 2,000	B.S. Bio/Teaching	93.1% Sch. Av.
Stephanie	5 years	@ 2,000	B.S. Biology.	93.1% Sch. Av.
Alice	4 years	@ 900	B.S. Bio/Teaching	78.8% Sch. Av.
Sean	19 years	@ 1,200	B.S. Bio/Teaching	89.9% Sch. Av.
Jennifer	3 years	@ 800	B.S. Bio/ Teaching	84.8% Sch. Av.
Kiera	4 years	@ 130	B.S. Nursing	<95% Sch. Av.
Walt	19 years	@ 1,700	B.S. Bio/Teaching	81.2% Sch. Av.
Grant	9 years	@ 1,100	B.S. Biology	78.0% Sch. Av.
Lacey	0	@ 700	B.S. Bio/Teaching	88.8% Sch. Av.
Katie	2 years	@ 1,400	B.S. Bio/Teaching	91.2% Sch. Av.
Melinda	3 years	@ 150	B.S. Biology	81.4% Sch. Av.
Karen	2.5 years	@ 800	B.S. Biology	75.3% Sch. Av.

Table 3

Percentage of Low Income Students in the School

Participants	% Low Income Students in the School
Alice	38.70 %
Teresa	11.00 %
Stephanie	11.00 %
Jennifer	48.84 %
Sean	35.86 %
Kiera	44.89 %
Walt	43.53 %
Grant	32.83 %
Lacey	47.75 %
Katie	22.92 %
Melinda	75.83 %
Karen	69.74 %

The following section describes the interview experience. A narrative of participants' interview is presented in chronological order with important or notable aspects of the participants and interview process. Interviews were conducted in the following order. Teresa (Career Status), Stephanie (Lateral Entry), Alice (Initially Licensed), Sean (Career Status), Jennifer (Lateral Entry), Kiera (Initially Licensed), Walt (Career Status), Grant (Career Status), Lacey (Initially Licensed), Katie (Lateral Entry), Melinda (Initially Licensed), and Karen (Lateral Entry).

Research Participant Interviews

Participants 1 and 2 – Teresa (Career Status) and Stephanie (Lateral Entry).

The following section represents the chronological order of participant interviews. Driving to the first school where I interviewed Teresa and Stephanie, I was surprised to see the amount of growth that has occurred over the last ten years. After exiting from the interstate, the road has been widened into four lanes, with new strip malls and restaurants along both sides of the road. The school was built in 2002, and according to other participants from other schools in the district; this is the school that “gets everything.” The Biology EOC performance for the school is 93.1%, and the state average performance is 81.2% (North Carolina Department of Public Instruction Accountability Division, 2008a).

When I arrived, Teresa laughed and told me that she and Stephanie just realized both were being interviewed today. Since it is a teacher workday, both teachers are relaxed and willing to talk at length with me about their experiences with the NCPTS and teacher evaluation process based on the standards. Teresa's room is organized, and the room is large with lab stations along the sides of the room. Stephanie's room is less organized, but she has

more student work displayed on the walls. Stephanie isn't wholeheartedly committed to teaching. She said she is still looking for a job as an environmental biologist. She also mentioned several times during the interview that she wants "to do just enough to fly under the radar." She reiterated several times throughout the interview that teaching is about the kids and not the required paperwork.

Note. (North Carolina Department of Public Instruction Federal Program Monitoring, 2011)

Participant 3 – Alice (Initially Licensed Teacher). Alice is in the final year of being Initially Licensed, next year she will be eligible for a continuing license and become a career status teacher. The interview with Alice was during her fourth period planning, and she didn't feel rushed to finish by a certain time. She wants to offer Advanced Placement Biology next year. It hasn't been taught since most of the students who typically enrolled in AP classes are now attending the recently built school in the district. The school where Alice teaches is in a rural section of the county, and there doesn't appear to be any new businesses or homes. The room is organized with Biology posters and student work is displayed. The school looks well maintained considering the age of the building.

Alice taught for one year in a neighboring county. She liked the vertical alignment meetings the central office arranged between high school and middle school science teachers. She would like to see it implemented here because she thinks it is beneficial for middle school teachers to know what students need to know for Biology and for high school teachers to know what the students have learned in middle school science courses. Alice laments that she has no money for lab supplies, and their technology equipment is limited and out dated.

The Biology EOC performance for the school is 78.8% (North Carolina Department of Public Instruction Accountability Services Division, 2008a).

Participant 4 – Sean (Career Status). Sean teaches in another school in the same school district, and he is very proud of the work that he, and his colleagues are doing. He requested that I share his name and the name of the school if I told anyone what they are doing to improve their Biology EOC achievement scores. He believes the largest impact they have had on their Biology EOC scores is the three-way rotation they do with all Biology students for the last 12 days of the semester before the EOC is administered. Sean offers a night session for parents and students to do some of the labs together. His goal is for parents to ask their child what they learned and stimulate higher-order thinking. Later in the semester, Sean offers an EOC review night, which he expects parents to attend so they can help their child prepare for the exam. He told me that parents and students from other schools have been coming to his EOC review night. The Biology EOC performance for this school is 89.9% (North Carolina Department of Public Instruction Accountability Services Division, 2008a).

Participant 5 – Jennifer (Lateral Entry). Two other teachers I interviewed are in the same school district, but they have different school environments. Jennifer teaches in a traditional high school setting, and Kiera teaches in a small school initiative sponsored by the Bill and Melinda Gates Foundation. Jennifer is discouraged with the misbehavior of some of her students and doesn't feel she has the same amount of support from administrators as other teachers. She chooses to send her referrals to the assistant principal who uses punitive punishment instead of warning students over and over. Jennifer is planning to become a

social worker and she, and her husband want to get certified as foster parents. Teaching has been discouraging for her because of some of the students' chronic misbehavior. Jennifer requested we meet during her first-period planning, and we were rushed near the end to finish before her second-period class came in. I think she wanted someone to share her disappointment with teaching. Her biggest complaint was about a group of unruly boys who may be active gang members. The Biology performance for the Biology EOC is 84.8% (North Carolina Department of Public Instruction Accountability Services Division, 2008a).

Participant 6 – Kiera (Lateral Entry). Although Kiera and Jennifer teach in the same school district, they teach in very different schools. Kiera teaches in a Health and Science High school small school initiative sponsored by the Bill and Melinda Gates Foundation (Gates & Gates, 1999), and she has been a presenter at the National Small Schools Conference. Kiera was a nurse before entering the profession, and she didn't explain why she left nursing, but she is enthusiastic about teaching and wants to be a teacher who others aspire to be. This environment has afforded her the opportunity to be a leader, and she takes pride in how well students are performing.

Kiera was instrumental in the science course sequence. She teaches the health curriculum for their 9th grade Health and Physical Education class, before students take the Earth/Environmental Science class that she teaches in the 10th grade. She believes more students struggle with the abstract concepts in Biology, so students take Chemistry in the 11th with a different teacher and then Biology with her in the 12th grade. The Biology EOC school performance is greater than 95% (North Carolina Department of Public Instruction Accountability Services Division, 2008a). Since this is the only teacher who teaches Biology

at the school, one can infer that the teacher has a correlation to the scores. She requires her students to read current events in Biology, which may provide more relevance to what students are studying. Ironically, the lack of laboratory opportunities did not have a significant effect on the EOC scores.

Kiera shared her dismay at the lack of laboratory facilities. The room has no water, few electrical outlets, limited lab supplies, and only four microscopes. This school is Health and Science Academy, but her room didn't appear to be a place of inquiry. Kiera collects science articles and books for students to develop their higher-order thinking. This small school is on the second floor of an older building. Although the building appears to have been well maintained, it has high ceilings, floors that creak, and few electrical outlets. The science classroom is in a classroom without running water, gas for Bunsen burners, or space to conduct laboratory experiments, which are typically found in most high school science classrooms. When the traditional high school moved to a new building, it left this building available for the new schools initiative.

Participant 7 – Walt (Career Status). Walt and I were both active participants in the science teachers' professional learning community facilitated by the university. He requested our meeting to be after school, and we met at a coffee shop on a Friday afternoon. He implemented a strategy known as issues based learning (Penick, 1989), and he felt strongly that it provided relevance, which helped motivate students to participate. However, it required more time than the pacing guide for the Biology SCOS, and he saw a decline in his students' Biology EOC exam scores. He still uses this approach as much as possible without jeopardizing student achievement. He holds a strong opinion for what we need to do

to improve science education in NC. He hopes the adoption of the new Biology essential standards, which go into effect for the 2012-2013 school year will allow more time for students to investigate meaningful biological issues. The Biology EOC performance for this school is 81.2% (North Carolina Department of Public Instruction Accountability Services Division, 2008a).

Participant 8 – Grant (Career Status). Grant teaches in the school he attended as a student. After he graduated from college he enlisted in the military and then returned to teach at his alma mater. He met me in the office and introduced me to the principal before we returned to his classroom for the interview. He requested that we do the interview during his first-period planning. We were briefly interrupted a couple of times for the administration internship duties he is fulfilling this semester. The school is in an area that attracts young professionals, and doesn't experience a lack of certified teachers. There are three Biology teachers at this school, and the Biology EOC performance data is 78% (North Carolina Department of Public Instruction Accountability Services Division, 2008a).

Participant 9 - Lacey (Initially Licensed Teacher). The lack of enough Initially Licensed and Lateral Entry teachers from school systems that implemented the NCPTS and Teacher Evaluation process in Phase I led to the search for participants from school systems that implemented them in Phase II. The school systems that implemented the standards in Phase I schools do not appear to be experiencing the lack of certified teachers, although one had a vacant position at the time of the investigation. Several school systems in urban areas and the rural eastern section of the state are finding it difficult to hire certified Biology teachers.

One of the participants in a Phase II school volunteered to be interviewed during her first-period planning. Lacey graduated from a public university and this is her first year as an ILT. Question one investigates teachers' perceptions of the need to improve teaching and learning in the classroom, school, school system, state, and nation. She felt strongly that the teacher education program did not prepare her for classroom management. Another issue in her preparation to become a teacher was the 5E lesson plan. The 5E lesson plan has been used as an effective innovation in elementary, middle, and high school Biology an instructional model that has been used in the design of BSCS curriculum materials since the late 1980s. This model supports the research reported in *How People Learn* (Bransford et al., 2000). Bybee et al. (2006) found ideas are best introduced when students see a reason for their use.

On the day of the interview, Lacey's school was on a two-hour delay for inclement weather. Since teachers reported an hour later, we had a full 90 minutes to conduct the interview. We didn't finish before school began, I offered to come back but Lacey wanted to finish the interview in her office. The office has a large window, so she could observe her students while they worked on an assigned project. Several times during the interview Lacey talked about respectful conversations. She uses this strategy to talk about creation when they did the unit on Evolution. Lacey is not concerned about the separation of church and state, and she says she is willing to lose her job over the right to teach creationism. Last year's Biology performance for the school is 88.8% (North Carolina Department of Public Instruction Accountability Services Division, 2008a). Lacey's students' performance is not included in the school report card for last year, since this is her first year as an ILT.

Participant 10 – Katie (Initially Licensed Teacher). Katie is a third-year ILT, and the interview took place during her 4th period planning and continued after school. When we left her room, the office was closed and only a couple of students were in the lobby using their lap tops. Katie shared some of the trials of teaching in a new school building. She teaches in a room with no windows, and the sensors turn off the lights whenever there is no movement. The lights go off when she works on the computer at her desk. She keeps a flashlight in her desk, so she can find her way to the door whenever it happens. Katie discussed her student teaching experience in Raleigh, and the graduate program in teaching she is doing online and during the summer at a school out west. The Biology EOC performance for the school is 91.2% (North Carolina Department of Public Instruction Accountability Services Division, 2008a).

Participant 11 – Melinda (Initially Licensed Teacher). The scarcity of ILT and Lateral Entry Biology teachers in the northwestern part of the state led to interviews with two Biology teachers who teach in school systems that implemented the NCPTS in Phase II. Melinda is an ILT Biology teacher who met with me in a bookstore coffee shop for the interview. The school where she teaches is involved in the small schools' initiative, and students have dual enrollment in the high school and a local community college. Students will earn a high school diploma and associate degree in five years. After Melinda graduated from college with a Biology degree, she decided she wanted to teach, and she enrolled in a college program that condenses education classes into summer school sessions. Melinda finished the requirements before she began teaching in the fall. Several members of her family are educators, including teachers, administrators and members of the board of

education. The school serves a population of students who will be the first generation in the family to attend college. The Biology EOC performance for this school is 81.4% (North Carolina Department of Public Instruction Accountability Services Division, 2008a). Since Melinda is the only Biology teacher at this school, one can infer that this is the performance of her students.

Participant 12 – Karen (Lateral Entry Teacher). The final participant is a lateral entry teacher from a school that received assistance from NCDPI Division of District and School Transformation until last year. Their overall proficiency of their students was below 60%. The Biology EOC performance of the school rose to 75.3% last year (North Carolina Department of Public Instruction Accountability Services Division, 2008a). Karen teaches with two other young teachers who have a successful PLC to plan lessons and reflect on their practice each week. Karen met me for dinner to do the interview in a nearby community for convenience and anonymity.

Table 4 shows a graphic picture of the data from the NC School Report Card (North Carolina Department of Public Instruction Accountability Services Division, 2008a) to show the range of racial percentages for White, Black, Hispanic, and Asian students in the participants' schools. Some participants teach in schools that have a majority of White students, and others teach in schools with a majority of Black students. There are also a range of Hispanic and Asian students illustrated in the table. NCPTS 2 expects teachers to establish a respectful environment for diverse student populations, and this study includes a broad range of student diversity (see Table 4).

Table 4

Student Population Percentages

Participants	White	Black	Hispanic	Asian	Unknown
Teresa	91%	3%	2%	6%	1%
Stephanie	91%	3%	2%	6%	1%
Alice	77%	15%	5%	2%	1%
Sean	80%	9%	8%	2%	1%
Jennifer	60%	18%	13%	6%	3%
Kiera	42%	25%	6%	27%	0%
Walt	85%	6%	4%	4%	1%
Grant	66%	26%	5%	2%	0%
Lacey	94%	0%	4%	0%	2%
Katie	95%	1%	2%	2%	0%
Melinda	27%	54%	10%	7%	2%
Karen	29%	62%	8%	2%	1%

Note. (North Carolina Department of Public Instruction Accountability Division, 2008a)

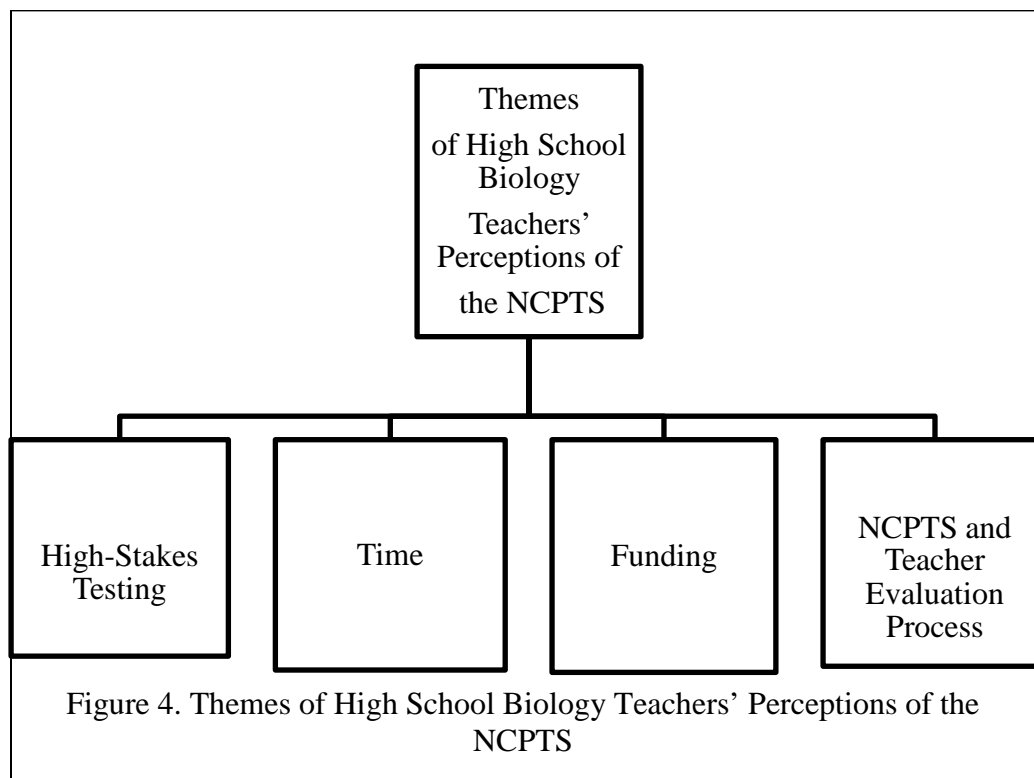
Findings

Qualitative researchers use coding and data displays to help organize, classify, and find themes in their data. Data collection was gathered during interviews, field notes, and emails. Member checks were used to triangulate the findings and develop converging lines of

inquiry through the data (Lincoln & Guba, 1985; Yin, 2003). Each interview was digitally recorded and transcribed. Phenomenological methods of narrative analysis began with broad patterns and themes (Rossman & Rallis, 1998). To find meaningful connections the researcher stays close to the data as it was originally recorded, which allows themes to emerge from the data (Glesne, 2006). The data coding consisted of reading and rereading the data to look for phrases and themes that existed within and across participants' responses to the interview questions.

In the first phase, each participant's transcribed interview was printed on different colors of paper to facilitate coding of responses. In the second phase, each participant's interviews were printed again and color coded with markers to look for repetitive phrases within and across each interview. In the third phase, each of these phrases was placed in a table, along with its corresponding page and line number of the interview transcript. In the fourth phase the themes, which emerged from the data were organized into another table, one for each theme.

For the fifth and final phase, the sub-themes were coded, which helped identify areas for further investigation. Concept Maps/figures were constructed to aid in the organization and presentation of the data. The themes that emerged from the data were: high-stakes testing, time, funding, and NCPTS and TEP. These themes were broken down into their various sub-themes for data analysis. Subsequently, each theme is discussed with its corresponding sub-themes along with the appropriate concept map/figure (see Figure 4).



Themes

High-Stakes Testing Theme. High-Stakes testing is nothing new to NC High School Biology teachers. What is different now is that Biology EOC scores are used as part of the data for NCLB (2001). This theme was pervasive in every participant's interview and the other themes also weaved in and out of the theme of high-stakes testing. Alice said:

Teaching EOC classes are stressful, the last two weeks of the school year, I was on bed rest before my baby was born, and all I wanted to do was come to school to help students review for the EOC. I tried to get the doctor to let me come in a wheelchair.

Alice isn't alone in this sentiment; Stephanie says she is judged by the EOC scores of her students. Karen believes more responsibility for the EOC is on teachers instead of students. Katie shared how embarrassing it feels when administrators use a Power Point

presentation with EOC scores at a faculty meeting. Figure 5 illustrates the subthemes for high-stakes testing (see Figure 5).

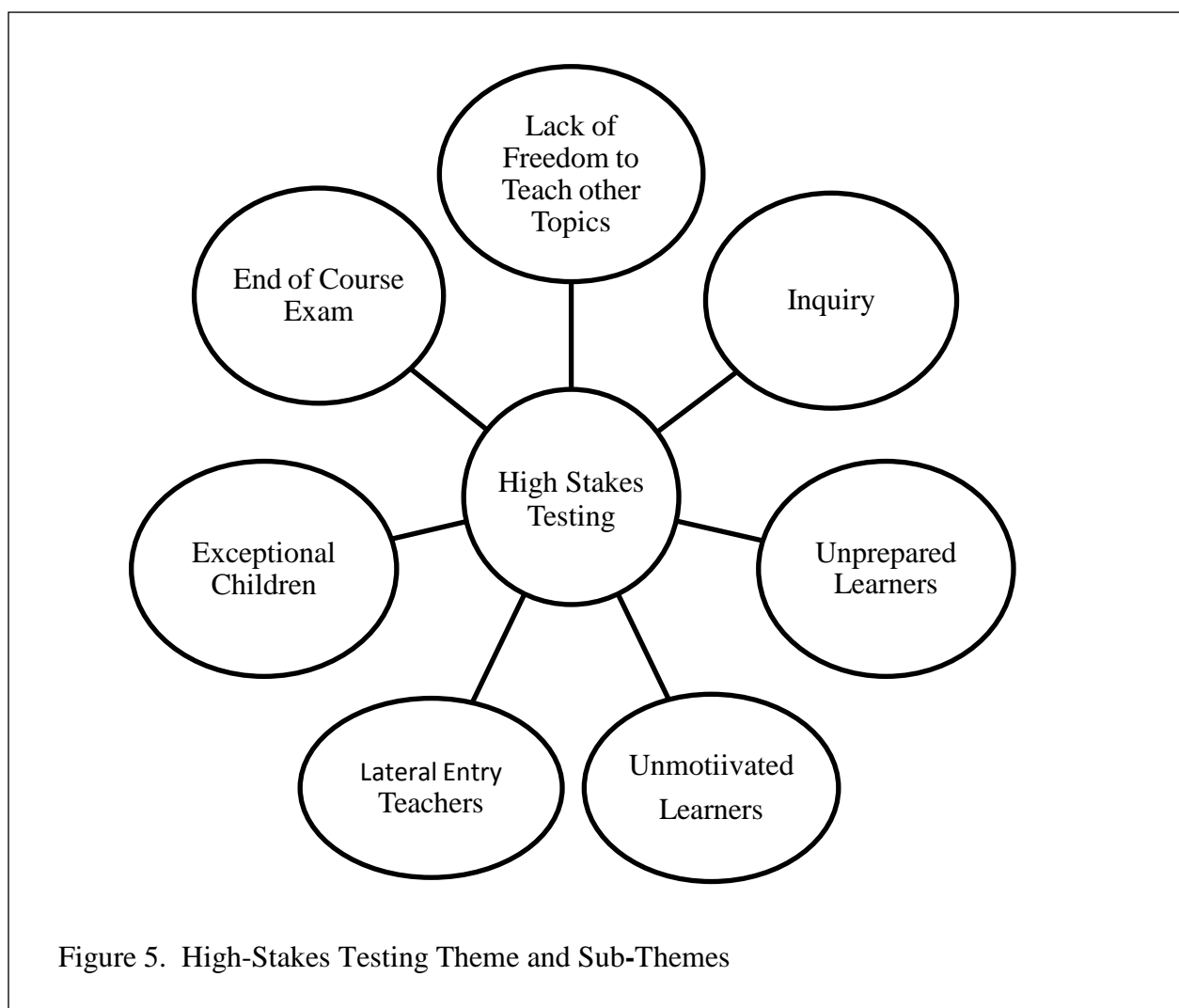


Figure 5. High-Stakes Testing Theme and Sub-Themes

High-Stakes Testing and the Lack of Freedom to Teach Other Topics. The three levels of Biology teachers include; career status, initially licensed and lateral entry teachers. They discussed the issues they have with the Standard Course of Study and the End of Course Exam, which make up high-stakes testing in NC. Although a question didn't specifically address or ask teachers about the Biology SCOS or EOC, it was mentioned most

often when they were asked what they think could improve teaching and learning. Teresa, a career status teacher with 29 years of experience, remembers when she could include debates for students to discuss current events and local issues, which made Biology more relevant to the lives of her students. She feels like students' appreciation for Biology has been affected by the EOC, and they don't get to spend as much time on parts of Biology her students are really interested in.

Stephanie thinks the emphasis on testing has taken away the opportunity to teach students how to assess an article for higher level thinking, creativity, understanding of what science is about, and teamwork. Even Kiera, with 95% of her students' performance on the EOC thinks "there should be more inquiry, but you cannot do inquiry-based learning because of the lengthy Biology SCOS. Her analysis of the EOC is "it's so specific its general because a vast array of questions can be asked on the EOC."

High-Stakes Testing and Inquiry. Walt wants students to have an appreciation for science, which he believes high-stakes testing diminishes. He believes we need to branch out and include problem solving in classrooms across the nation, and we need more hands-on learning that requires collaboration. Walt believes we need to branch out and include problem solving in classrooms across the nation, and we need more hands-on learning that requires collaboration and teamwork. He also believes the EOC stifles inquiry because it takes time for students to do a meaningful investigation, which includes developing questions and designing an experiment to test their hypothesis. He uses *Biology: Community in Context* (Penick, 2003) whenever possible, although his Biology EOC scores suffered the first time he used it for the entire course. He still uses several of the activities and labs because

“students loved the class, and I had fewer discipline problems.” Walt believes the SCOS is so full it doesn’t leave enough time to do as much inquiry, but he feels strongly that “we need to have more inquiry-based instruction.” Kiera, whose students achieve greater than 95% performance on the EOC, said,

There should be more inquiry, but you cannot do inquiry-based learning because of the lengthy Biology SCOS. The EOC is so specific its general, because a vast array of questions can be asked on the EOC. Unless you have an idea or sense of what’s been on a test, you could go crazy trying to make sure kids know the best thing for the test, but the best thing you can do is teach them how to read and write, how to speak, and how to solve problems.

High-Stakes Testing and Unmotivated Learners. Grant invites guest speakers to talk about their science-related careers to help students who lack motivation, but he worries about the lost time for the SCOS instruction. Walt told me that his students say the only reason they are in school is to keep their drivers’ license. He also talked about students who “buzz sawed through three of our newest teachers; they are a bunch of smart honors kids who don’t want to do any work.” All of the participants except one talked about the unmotivated learner. Sean was the only one that didn’t mention it specifically.

Sean spent a lot of time talking about the parent night at the beginning of the semester when goes over some of the labs students have been doing, and the EOC review night for parents and students at the end of the semester. Sean also talked about what he did to organize homerooms. He volunteered his time this past summer to match students with teachers who share the same interest. Students meet with their teacher each week, unless they

need to be tutored or complete make-up work. This provides opportunities during the regular school day to prevent students from getting behind in their school work. Grant's school has also built a make-up/tutoring schedule for students into their regularly schedule school week.

Katie compared the lack of her students' motivation with a student she had from China. She was amazed at how hard the student worked to learn the curriculum and get good grades compared to the efforts her students put forth. Several participants, including Kiera, who said her students, would rather do a worksheet to fill in the blanks than do an activity that required them to use higher-order thinking. Teresa aptly summarized what many of the participants expressed. Teresa said:

Students don't want to do anything, and they could achieve more if they would apply themselves. They don't read some of the stuff we have to teach, and they take the EOC and it will not make any difference in their lives. I have to constantly pull them through and try to get them to do what they need to do and keep them interested. We spend too much time on cells and genetics, but students are interested in plants and animals. I cannot see that all this on testing is making our students smarter, overall. I think it's weakening them because we are putting all the value on one test, and it doesn't give them an appreciation for learning. You're asking someone to do this hard job for a little amount of money. Teaching Biology isn't fun anymore. They sucked the fun out of it.

High-Stakes Testing and Unprepared Learners. The 8th grade science test is one of the measures for NCLB. Walt has a son in 8th grade, and he said, "they have not been getting science in the lower grades, I know because my son is in middle school, his 8th grade teacher

has been trying to make up for eight years of science not being taught.” Jennifer thinks our testing lacks flexibility for students’ different learning styles, and students coming from middle school are unprepared for high school Biology. Grant shared with me that his students struggle with the lengthy EOC questions because it’s too much for them to read. Stephanie believes kids learn to memorize word for word with no context or meaning in elementary and middle school, which leaves them unprepared for high school.

High-Stakes Testing and Lateral Entry. Jennifer is a third year lateral entry teacher, and she talked at length about the problems she faces with student disruptions in her fourth period class. She is fearful of the gangs in the school, and shared a situation when she found herself alone in the hallway with students who were returning from an assembly. She was trapped in the midst of the boys as they started jumping up and down and hitting each other as they yelled gang chants. Although these students were suspended, one of them is in her fourth period class, and his influence on others has been disruptive. The assistant principal has been too busy to help her. The state of NC provides mentors for its beginning teachers; this school hires retired teachers, but Jennifer has had four different mentors in three years and lapses of service between mentors. Jennifer also teaches Advanced Placement Biology, which is a stressful situation by itself. She is struggling with her decision to teach, and she is considering becoming a social worker instead of remaining in the classroom.

High-Stakes Testing and Exceptional Children (EC). When Sean shared, “I don’t know what they’re thinking down there (NCDPI), having the Occupational Course of Study (OCS) kids do everything the same as everyone else, it’s insane, it’s another way of keeping us from getting our ABC (Accountability) money.” However, Sean added this contradictory

statement, “those kids sure like being involved with the rest of the kids, so we may consider trying it again.” Sean also believes the OCS students can learn, but you have to make it exciting and allow them to do what all the other students get to do. Teresa said, “she didn’t understand why some of those Exceptional Children need to have Biology. They need to have an appreciation for the world they live in and be good stewards of their environment.”

Several of the participants have an inclusion class, which means they have a Special Education teacher in the class with them when they have EC students enrolled in the class. Some of the participants said the inclusion teacher doesn’t help very much in the classroom or do anything with them during planning. Participants realize the faltering economy and budget cuts to education have made it necessary to have larger class sizes, but it makes it more difficult to meet the needs of the EC student. Teresa wonders why the EC students have to go back and take Biology repeatedly because they fail the class and/or EOC. She also doesn’t believe school is providing the EC student with what they need when they leave school, but she agrees we are making education accessible to them.

High-Stakes Testing and the EOC. With the pressure of high-stakes testing and the requirement of passing the EOC to be able to earn credit for graduation, students were given two additional opportunities to retake the EOC without having to retake the class. Teachers have mixed feelings about this, and Jennifer said, “It drives me insane when the state allows students to retake the test because it lowers the standards.” Last year, the State Board of Education changed the policy and now students with a passing overall average can earn credit for graduation. However, it was left up to the local Boards of Education to implement

the new policy or not. Teresa has mixed feelings about students not having to pass the EOC to graduate, and wonders why we have put all the emphasis on testing.

The emphasis on testing has emphasized going back and looking at the data. Alice looks at the data to see where her students are and what the data indicates I need to improve. Several teachers discussed their effective and ineffective professional learning community (PLC). The teachers who have high EOCs tended to have a higher regard for their PLC. Several participants said they had the best PLC in the school, while others like Jennifer lamented that theirs wasn't meeting their needs.

Jennifer is the only female in the Biology PLC made up of mostly older males. Jennifer longs for a female science teacher whom she can connect with. Luft, Roehring, and Patterson (2003) found there is a need for specialized support programs for beginning science teachers. Katie is also the only female in her Biology PLC, and she wishes she had a female science teacher close to her age that could help her. Katie finds support for teaching and reflection with the students in her online graduate classes. Herrington, Herrington, Kervin, and Ferry (2006) reported that teachers can find emotional support and feel less isolated when they use online support groups.

Grant believes that Biology should be offered as a year-long course on block scheduling, which some schools in NC have implemented as a pre-Biology before students are enrolled in the Biology with an EOC. Many of the participants, including Alice think there is too much to cover in the Biology SCOS. Stephanie believes the EOC "has lowered the expectations for students, because that's the level teachers will teach to." She also believes the low-level EOC does not get students ready for the 21st Century. Several

participants, including Grant complained that the EOC is limited to multiple-choice questions. All the participants use the released Biology EOC as part of their review for the test. Many of the school systems administer common assessments, which some participants felt strongly that they didn't match with the EOC type questions. None of the participants were neutral about the EOC. Some believe it is necessary because some teachers wouldn't do the work that it takes to teach an EOC course.

Time Theme. Time is a second theme that permeated the interviews with participants. This theme has the following sub-themes including: resources, science labs, students, technology, school district central office, and NCPTS (see Figure 6). Without being redundant, the issues of time to teach a rigorous Biology SCOS, Biology EOC, and time to teach unprepared and unmotivated learners have been discussed with the high-stakes testing theme. Three of the participants discussed how their school has scheduled extra time for tutoring in EOC classes sometime during the regular school day or week. Some of the schools across the state provide transportation for after school tutoring. However, none of the participants in this study mentioned this for their schools. These strategies of allocating additional time for students in EOC classes is a direct consequence of high-stakes testing, and the pressure on schools to have their students to perform successfully on high-stakes testing.

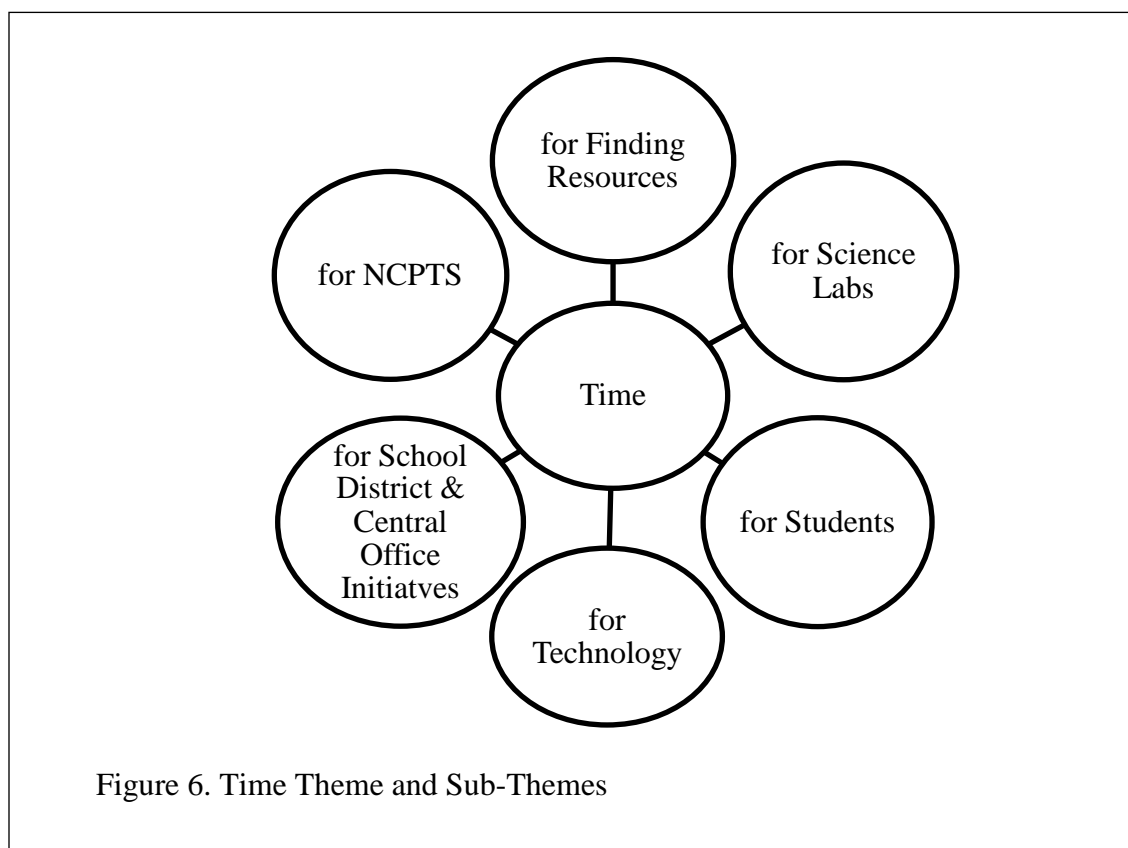


Figure 6. Time Theme and Sub-Themes

Time for Finding Resources. All the participants said something similar to Teresa’s statement, “there is a small amount of time to cover so much content.” Many of the participants said they didn’t have time to do a variety of things they knew would be beneficial for their students. Sean said he knew of the new Revised Bloom’s Taxonomy (RBT) Science Units for Biology on the NCDPI web site, but he didn’t have time to find them, others said they didn’t know anything about this resource. The Revised Bloom’s Taxonomy K-12 Science Units are an additional resource for teachers, which are available on the NCDPI web site. These RBT K-12 Science Units provide the RBT tag for higher-level thinking, exemplary lesson plans for each instructional day, as well as laboratories, supply

lists, and links to web sites for additional information. Unfortunately, few of the teachers in this study utilize them or aware of their existence.

Dr. Loren Anderson is the author of Revised Blooms Taxonomy and one of the authors of *Taxonomy of Learning* (Anderson et al., 2001). He conducted the training for the North Carolina Educators, who wrote the K-12 Science Units, as well as edited and approved of all the units. These resources have been publicized with the NCDPI list serves, NC Science Teachers Association, NC Science Leadership Association, Messages to Superintendents from the State School Superintendent. This example illustrates the ongoing issue for teachers to have time to find available resources (see Figure 6).

Time for Science Labs. Sean was very dismayed with his experiences with the teacher education program in a small private college did not prepare him how to set up labs for his students. He called several of his professors when he began teaching, and asked them to allow him to assist with lab preparations. He wanted to know how to order, how to set up lab equipment, how to store items, how often lab items were used, how to budget, and to advocate with administrators for the necessary funds he needs to conduct labs. Sean said, “It is paramount above everything else for the teacher to stay abreast of the current way of thinking and current trends,” and then he said, “When am I going to have time?”

Jennifer was also dismayed with her Biology students who took the glass balls that are used in the Advanced Placement Biology Respiration Lab. She found it frustrating to have first period planning because she needed to set up the lab for AP, which is taught later in the day. This leaves equipment and materials out on the lab benches for her other students to plunder and steal the equipment and materials.

As a lateral entry teacher, Karen does not teach Honors Biology. The school where Karen teaches has been a low-performing school until two years ago, and with almost 70% of their students classified as economically disadvantaged. The only participant who teaches in a school with a higher percentage is Melinda, but her school is an early college high school with students who have an interest in going to the local community college.

Time for Students. Grant says, “Classroom management and a storm of paperwork take all my time.” Karen shared “it is too much to expect teachers to notify every parent if their child is failing.” As a lateral entry teacher, Karen does not teach Honors Biology. The school where Karen has been a low-performing school until two years ago, and with almost 70% of their students classified as economically disadvantaged. The only participant who teaches in a school with a higher percentage is Melinda, but her school is an early college high school with students who have an interest in going to the local community college.

Karen’s school is a traditional high school that serves the community. Karen probably has a higher percentage of students who are failing, which would demand a tremendous amount of her time at work and at home to call every parent. As a lateral entry teacher, Karen confessed that classroom management has been an ongoing struggle for her. She connects with students because she cares about them, but she has difficulty being firm, so she lets things slide instead of dealing with it. When this happens, students take advantage of the situation, and she has difficulty getting everyone to pay attention to the lesson.

As an initially licensed teacher Melinda confessed that she had to master the content and now that she is more familiar with the content, she’ll have more time to reflect and do a better job presenting the information. Teacher reflection emphasizes the importance of

teacher inquiry (Valli, 1997), and it is a way to incorporate equity and social justice into teaching thinking and practice (Howard, 2003). Melinda teaches in a school with the highest percentage of economically disadvantaged and minority makeup of the schools in this study. Melinda is aware and she is sensitive to the needs of her students. One of the NCPTS is teacher reflection, and Melinda took time to carefully think about her responses. She described how she tries to pull disruptive students aside and talks to them. This allows her to understand why they are disruptive and help them understand why this behavior is inappropriate. She attends the monthly science teachers' professional development activities offered by the school system each month. She said what she learns enhances her abilities to teach all students.

Kiera teaches in a school supported by the Bill and Melinda Gates Foundation's National High School Initiative that endorses the three Rs of rigor, relevance, and relationship. Numerous studies have validated the need for the three Rs, and studies have shown relationships are essential to the success of many students (Fedore, 2006; Lambert, Wallach, & Ramsey, 2007). Shear, Means, and Mitchell (2008) undertook a five-year study of the small schools initiative and found these strategies have the potential to promote a learning environment that is more personalized and encourages students to work to higher standards, but they must be taken in the context of the typical slow pace of significant education reform. Despite the issues that face many startup schools for limited budgets and incompatibilities with the school districts they are located in, these schools have been able to establish strong and supportive school climates without compromising student achievement.

Kiera's school has a framework for the students and teachers to be in families, where students are able to share whatever is bothering them. She also provides time in the evening that she will accept phone calls at home from her students, but she was also quick to draw the line for the limits of this relationship. She is there to be a mentor, but not their friend. She also discussed the importance of establishing an environment of trust that she uses from Harry Wong's *First Day of School: How to be an Effective Teacher* and Ron Clark's *The Essential 55* that she uses to guide her classroom management style. She buys new t-shirts to give students the first day of school for them to decorate with symbols to represent things about themselves, and they must do this without words.

Walt was the most passionate about the importance of student relationships, he says, "I am determined to find out by the end of the year, what makes this child tick, and I care about him." He has to find some way to motivate students to pass the EOC and he realizes the stick isn't going to work; he has to find a carrot. Lacey repeatedly stressed the importance of the need for students to learn how to have "respectful conversations." Melinda believes she is sensitive to her students' needs, and she knows when not to push a student too hard because they have issues from home that is preventing them being fully present. Students have picked up on her caring nature and often confide in her to share their troubles.

Time for Technology. Teresa shared with me that her administrators want her to include more technology in her lessons. Teresa has 29 years of experience and she wonders it's worth the time. Walt on the other hand, wants to use more technology, and he has a Smart board, classroom performance system (clickers), and projector to use with his computer. He doesn't have any computers in the room for students to use programs and

activities he values. He would like for his students to have more opportunities to use SASinSchool and web quests. He shared how frustrated he recently felt that he couldn't take his students to the computer lab because it was booked for weeks in advance. By the time he could schedule the lab the students would already be tested on those objectives.

The media coordinator at Walt's school relayed his frustration to an administrator, who came to talk to him about the problems of scheduling the computer lab. Since they only have two computer labs and no mobile lab carts at the school with 1,700 students, it is an ongoing struggle for many of the teachers to implement 21st century skills. Lacey complained that they do not have access to a laptop cart in the science department, because they are downstairs and there is no elevator. Teachers are feeling the pressure to provide opportunities for their students to utilize 21st century skills and frustrated that there is not enough computers in the school to meet this expectation.

In contrast, Teresa and Stephanie teach in a school with 2,000 students, five computer labs, and several lab top carts that they have access whenever they need them. Melinda, Karen, Katie and Kiera teach in schools that have received grants to purchase enough computers for every student. However, Kiera complained that technology problems are frustrating, and you can lose valuable time waiting on technology to work. The NCPTS IV says, "Teachers integrate and utilize technology in their instruction," which places the burden of proof on teachers. Both Alice and Walt shared their frustrations about the lack of technology resources in their schools.

Time for the NCPTS. The most repetitive phrases throughout all the interviews was the remark, "I just check the boxes." The Teacher Evaluation Process that is the evaluation

piece of the NCPTS has a self-evaluation checklist, that participants said, “I just check the boxes.” This group of teachers believes it takes too much time to do the self-evaluation, because they already have so many demands on their time; this new model is time consuming. Without being redundant, many of the issues with time have been discussed with the high-stakes testing theme.

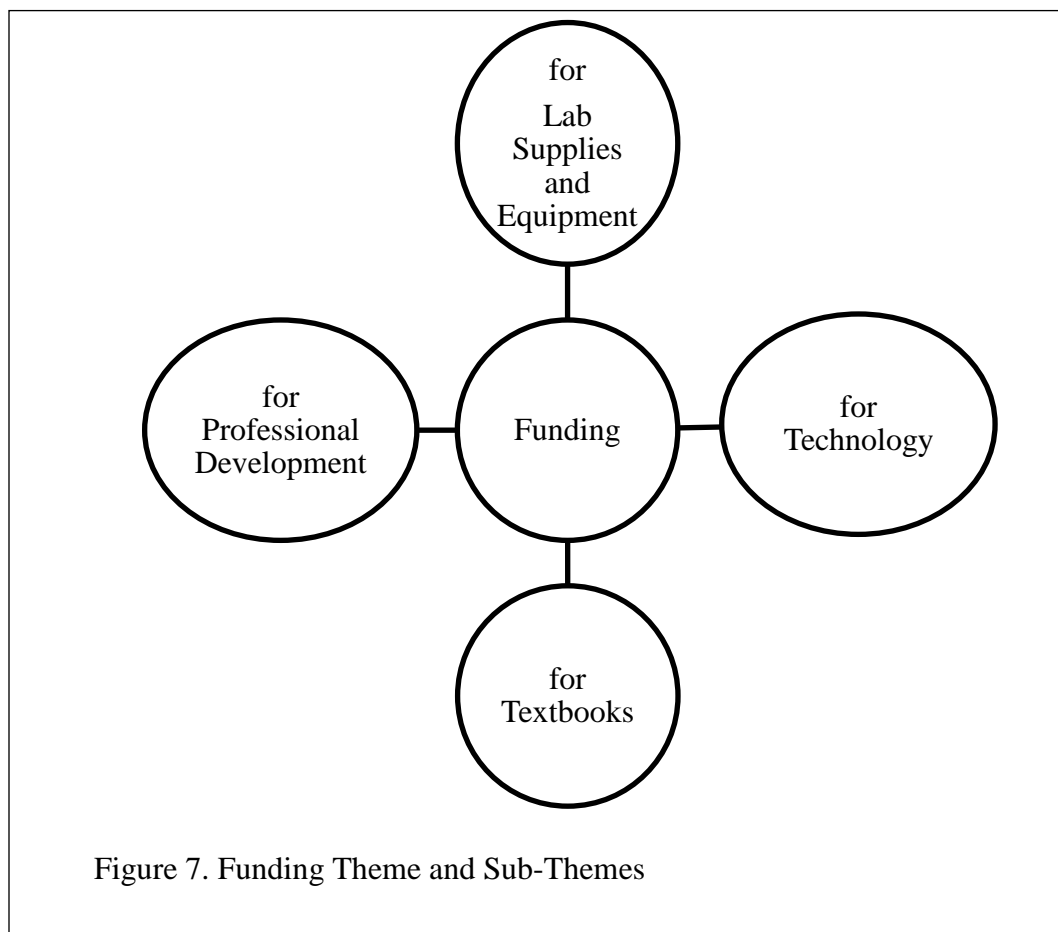
Time for School District Central Office Initiatives. Grant complained that the county curriculum coordinator gives extra work that he thinks is a waste of time. Several participants complained that their School web pages that are made by someone at the central office are not user-friendly, and they spend too much time trying to load files. Teresa doesn't like the county pacing guide because it limits the time you can spend on a SCOS goal and objective. This makes it difficult to share equipment and resources that everyone needs at the same time. Several participants complained about the common assessment that their central office requires them to give with their students. If teachers are not aligned with the county pacing guide, their assessment data are flawed and unusable. Some of the teachers didn't agree with the sequence and order of the goals, which eliminates their ability to make decisions they think are best.

Some of the larger school districts have implemented common assessments as a way to ensure students receive an equal education. Grant has an issue with his school systems' purchase of test items written by a new business. This business is made up of retired educators, and Grant believes his school is paying too much money for poorly written questions. He would rather have the money to use for science labs for equipment and consumables that need to be reordered for each lab. Karen and Melina dislike common

assessments because it takes time away from the instructional days before the EOC is administered.

Another problem for common assessments is the lack of leadership and professional development for teachers to understand the best practices of the professional learning community. Sean goes over the common assessment data with each of his students, but he says, “the only bad part of this is it takes a long time out of your class time to do this.” The PLCs at Alice’s school isn’t functioning because teachers have multiple teaching assignments. In summary, the interview transcripts are littered with this simple statement in various places throughout the interviews, which is “I don’t have time.”

Funding Theme. As a consensus with every participant they all said they needed funding for lab supplies and equipment, they needed their microscopes cleaned. Everyone spoke of how the Budget Crisis has impacted their classrooms and their own professional development. Classrooms are feeling the pinch because they are still held accountable with the high-stakes Biology EOC. These teachers do not believe they have the funding for the materials they need to engage students or provide contextual meaning for science processes. They believe these resources are necessary to help students have a love and appreciation for science (see Figure 7).



Funding for Lab Supplies and Equipment. Grant summarized the overall sentiment for several of the participants; he complained that the county is using the money on common assessments that could be spent more wisely on lab supplies. He identified one of the problems NC teachers face with funding. Allotments are made to schools from the NC General Assembly once each year. Any funds that are not spent in the allotted time must be returned to the state. This is in conflict with the NSES suggestion for science teachers to have funds readily available for student inquiry (Center for Science, Mathematics, and Engineering Education, 2009). Experienced teachers know they will have access to funds

later in the school year, so they can plan what they need to buy for the following school year. However, this leaves the beginning initially licensed and lateral entry teachers without funding for consumable lab supplies. Many of the participants spoke of how much they spend of their own money to buy things for their classrooms.

All of the participants lamented they didn't have funds available to have their microscopes cleaned since the NC budget crisis began a couple of years ago. Kiera is disheartened because she only has four microscopes for the entire class. Her classroom is not a science lab and it has an inadequate number of electrical outlets needed for science lab equipment and technology. She laughed when she talked about using the microscopes because it caused the breaker box switches to turn everything off. Jennifer said the best thing she can do for her troublesome 4th period class is to do lots of labs, but she doesn't have enough funds to do them, unless she pays for the items herself. Although there are organizations like *Donor's Choose* for teachers to apply for funding to purchase the things they would like to have in their classrooms, not everyone knows this, including many of the participants I interviewed.

Funding for Textbooks. All four of the initially licensed and three lateral entry teachers complained they don't have enough textbooks for every student. Some people argue textbooks are obsolete, but they fail to realize many of our classrooms don't have the technology that enables them to access information when they don't have textbooks. The Science adoption of new textbooks would have occurred in 2009, with new books available for the 2010-2011 school year. The state's budget crisis has prevented the purchase of new

science textbooks. So now our classrooms have outdated and inadequate numbers of books for a high-stakes tested curriculum.

Lateral entry teachers have fewer tools in their tool box, and this takes away their main resource. The other problem with the remaining textbooks is the abuse many have suffered over the past seven years, and many of the books are literally falling apart. Karen's school has experienced a high rate of teacher turnover in the science department, and she doesn't have enough books for a class set. She also doesn't have the ancillary materials that came with the book. Karen said, "I didn't have enough books or a data projector the first year and a half. We also don't have enough copy paper, so it was really difficult to give students something to read."

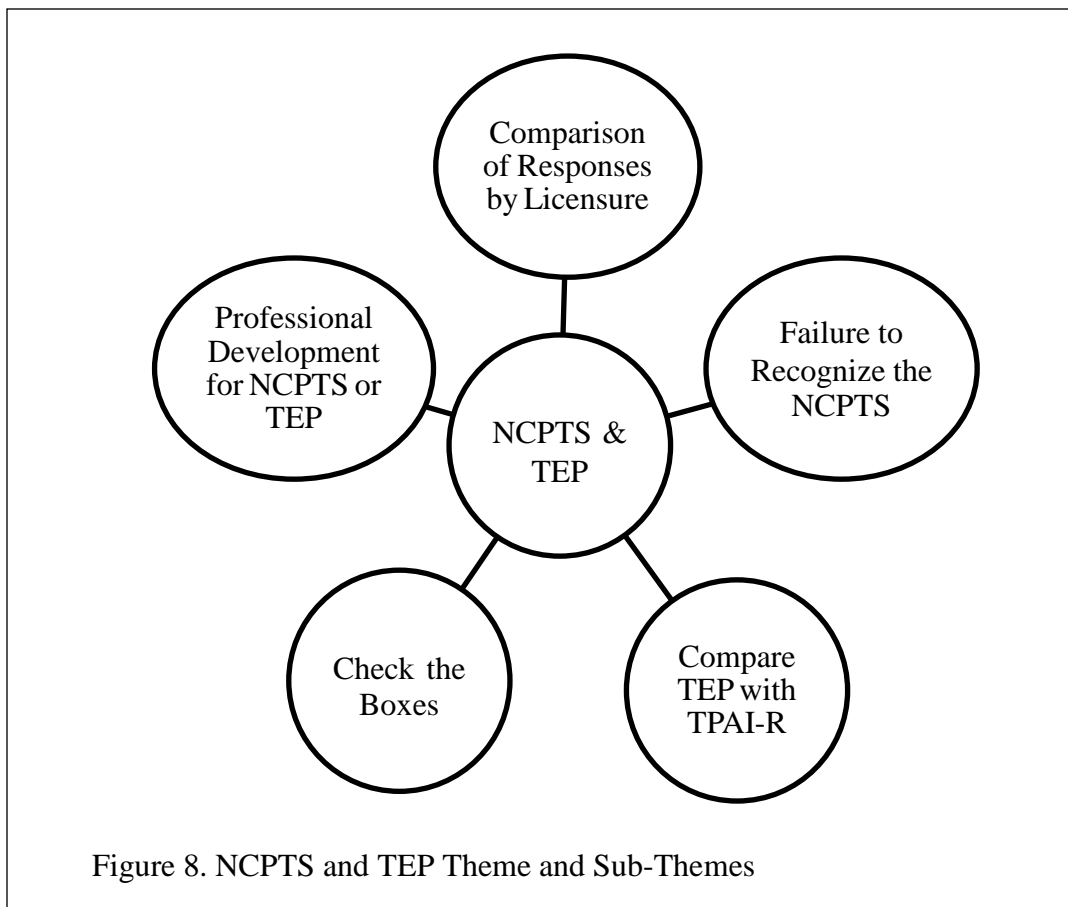
Funding for Technology. This issue was discussed in the high-stakes testing and time themes. However, one of the technology issues also includes science equipment for lab investigations. Probes are used in a variety of investigations, including; temperature, photosynthesis, and respiration. This data is used to generate graphs to illustrate the data and make conclusions. Some of the participants in this study do not have the basic setup that many teachers have in classrooms today. All the teachers in this study have a desk-top computer to record attendance and emails, but they don't have computers for students to use.

Most of the participants I interviewed have a data projector, several have written or participated in grants to be able to have these essential pieces of technology that 21st century learners take for granted. None of the participants mentioned using cell phones for any activities they can be used for. Sean believes teachers must keep up with technology and the

new things that are occurring in science almost daily. “It is imperative that you stay on top of things, if you’re not, students say you don’t know what you’re talking about.”

Funding for Professional Development. Alice changed schools this year, and she was disheartened to learn she couldn’t attend the NC Science Teachers Association (NCSTA) meeting in Greensboro because there were no funds for professional development. Karen’s school doesn’t have the money for her to attend any professional development that is not provided by the school. Teresa and Stephanie also said they were not allowed to attend the annual NCSTA meeting for the past two years because their school didn’t have the money. Walt said, “If it were not for the Science Professional Learning Community with the University’s Public School Partnership, I wouldn’t be able to do anything outside of the school for professional development.” Melinda is the only participant who said she has attended national professional development; this opportunity was available through the Small Schools Initiative.

Teacher Evaluation Process (TEP) Theme. There were no specific questions about the TEP, however, it was mentioned by all of the participants. From their responses the TEP theme and sub-themes emerged from the data. The sub-themes are the participants’ failure to recognize the terminology of North Carolina Professional Teaching Standards, comparison between the TEP and Teacher Performance Appraisal Instrument Revised (TPAI-R), professional development they received in preparation to be evaluated with the TEP, and check the boxes (see Figure 8). The three licensure types were used as another source of comparison for this theme.



Comparison of Responses by Licensure. The participants responses were grouped by licensure to search for commonalities and differences. The three licensure types include; Initially Licensed Teachers, Career Status Teachers, and Lateral Entry Teachers. Four participants for each licensure were interviewed for this study.

Career Status Teachers. Most of the participants like the Teacher Evaluation Process, which is the evaluation instrument that accompanies the NCPTS. Although there was no direct question about the Teacher Evaluation Process, it permeated all of the participants' responses to the secondary questions they answered (see Figure 8). Each of the participants' responses to this theme were grouped according to the teaching licensure. Teresa shared with

me that her principal wants her to include more technology and assume more leadership. Walt said he had looked over the NCPTS earlier that day and “you don’t remember all of them unless they are right in front of you.” He also told me he would say the same thing about the standards whether it was with me or the superintendent.

Sean knew the least about the NCPTS and Teacher Evaluation Process because he is not in the license renewal cycle to be evaluated. He thought the interview was about the new Biology Essential Standards. However, once we began talking, he realized the homeroom grouping of teachers and students by interest that he worked on all summer could be counted for the NCPTS for leadership. Grant didn’t recognize the NCPTS or Teacher Evaluation Process either; he wanted to discuss his opinions of the current Biology SCOS.

Initially Licensed Teachers. Alice refers to the Teacher Evaluation Process when she is going to be observed. She also told me her husband works in a neighboring school system that is talking about going to pay for performance. Now that he no longer teaches EOC classes with EOC scores, he is worried that he will not be able to make as much money. Lacey had not been observed yet, but she said he knew about them from the university supervisor she had for student teaching. Katie said she was so wrapped up in her online graduate classes that she had not had time to think about the evaluation very much. She said, “I want to do something with literacy for my students and I looked at the Teacher Evaluation Process to see where it fit in so I could do it.”

Lateral Entry Teachers. Stephanie said, “I know this is really bad, but I go through the list and check proficient on most of the things and I check a few accomplished. I don’t want to have a lot of accomplished because they might make me teach something that really

hard.” Jennifer is upset that her principal doesn’t have time to sit down with her and tell her what she needs to do to be proficient or accomplished. Kiera said at the beginning of her interview that the “teacher evaluation process is highly emphasized over and over.” Karen wasn’t sure about what the interview was about for the NCPTS, she had to ask her department chair earlier that day to know it was in reference to the Teacher Evaluation Process.

Failure to Recognize the NCPTS. I was surprised to learn so few of the participants recognized the terminology of the North Carolina Professional Teaching Standards. Several thought I was referring to the new Biology Essential Standards when they responded to the first question. Only Kiera recognized the terminology right away, and Melinda did as soon as she knew I wasn’t referring to the Biology Essential Standards. Teresa and Walt both confessed they looked it up just before we met for the interview. When I referred to the Teacher Evaluation Process, six of participants realized what I wanted to discuss with them. Only Sean and Grant needed further prompting to clarify the purpose of the study. From these responses, the NCPTS are not seen as a stand-alone document, it is in reference to teacher evaluation.

Most of the participants responses for the NCPTS and Teacher Evaluation Process are weaved throughout the previous themes of high-stakes testing, time, funding, and the NCPTS and Teacher Evaluation Process. However, there are some caveats that have not been discussed thus far. The professional development that the participants received for the implementation of the standards indicates a varied approach to prepare these teachers for

how they are evaluated. Initially licensed and lateral entry teachers are evaluated annually. It is used with career status teachers during the year of their license renewal cycle.

Comparison of the TEP with TPAI-R. Several of the participants said they don't believe the Teacher Evaluation Process can capture everything they do in their classroom. Walt said,

As far as knowledge of the material and how much you are participating with the school and community, I think it does a good job if you are honest with the self-assessment. It helps pinpoint what you do well and what you need to improve. I don't believe you can capture someone's teaching style in one document, but I like it better than the TPAI-R, in the past it was a "dog and pony show. I didn't get all the checks to the far right side, and I don't think anybody could because hopefully each year you are moving closer to that ideal model of teaching. It is one of the best pieces of bureaucracy I've seen in a long while.

Check the Boxes. Although there was not a specific question about the Teacher Evaluation Process, a phrase was said by each of the participants whenever they talked about the evaluation. All the participants said at some point during the interview that they or their administrator "check the boxes." This phrase was an easy one to tabulate because of its distinctness. For some checking the boxes was the tool it was intended for self-assessment, while others like Stephanie, didn't want to have to find all the documentation to show she was distinguished. Stephanie said, "I just want to fly under the radar." She wanted to "do enough to be left alone and not have this process take up too much of my time."

Several participants said the self-evaluation forces them to be honest with themselves about their strengths and weakness as a teacher. However, most of the participants identified the need for the principal to have more time to not only do the evaluation fairly, but also have time to sit down with them, and explain what they need to improve. Kiera said, “I would throw up my hands and give up if I were in a school with 70 teachers, and the principal comes for 50 minutes to evaluate everything I do. Everybody has bad days, and I don’t want to be judged for those few hours of observation for what I spend hundreds of hours doing all year.” Jennifer was almost in tears when she told me she wanted the principal to have time to sit down with her and tell her what she needed to do to improve. She said that she understands the principal is busy, but he had broken several appointments for observations and post conferences and when she was finally able to meet with the principal, he was in such a hurry, that she didn’t receive any valuable feedback.

Professional Development for NCPTS and TEP. Most of the participants only received professional development for the standards at an afternoon faculty meeting after school. Karen received training for the NCPTS and Teacher Evaluation Process during four early release professional development days. Melinda spent a five days of professional development for the NCPTS and Evaluation with the NC Teacher Academy. The teachers who have been evaluated with the TPAI-R (Teachers Performance Appraisal Instrument Revised) prefer the Teacher Evaluation Process (see Figure 8).

Alice along with many of the other participants identified the need for further professional development to have a better understanding of the standards and teaching best practices. Most of the participants only refer to the standards when they are being evaluated,

they do not use the standards to guide their teaching, professional development or reflection. Kiera feels sorry for those teachers who haven't had a lot the opportunities to do the things she has done with the new schools project. She wonders why a lateral entry teacher who needs to focus on teaching should be penalized for not having everything. Like Stephanie, others said they don't always document what they do. Finally, Kiera whose students have performed at the highest level on the EOC said, "The public judges me according to that stupid school report card, and if the scores don't look good that's that how I'm evaluated. Not these wonderful standards."

Primary Research Question

The primary research question is: What are high school Biology Teachers' perceptions of the NCPTS as a tool to improve their teaching and student learning in a high-stakes testing environment? Eleven teachers have been evaluated with the Teacher Performance Appraisal Instrument- Revised, and they all believe the Teacher Evaluation Process is a better instrument to evaluate their teaching performance. Only Lacey, as a first year ILT has not been evaluated with the TPAI-R. However, the research question specifically sought to understand teachers' perceptions of the NCPTS. These standards are grounded in best practice and provide teachers with an outline of what then need to do to be an exemplary teacher.

Kiera was the only teacher that recognized the NCPTS when it was mentioned during the preliminary explanation for the purpose of this research. Career status teachers, Sean and Grant had the least amount of knowledge of the NCPTS and Teacher Evaluation Process.

Nine participants associate the NCPTS in context with the Teacher Evaluation Process. The following cross case displays reveal the responses to the secondary questions.

Cross-Case Displays of Secondary Research Questions

Cross-case displays assist in explaining the complex network of conditions and effects. The problem is how to draw well-founded conclusions from multiple networks (Miles & Hauberman, 1994). The cross-case displays were constructed to assist with the comparison and analysis of the secondary questions. Participant's responses to the questions provided the data from which the four themes emerged. The cross-case display of the data also supported the triangulation of the data. The following cross-case displays of responses to the secondary questions are listed in order.

Question 1: How do Biology teachers perceive the need to improve teaching and learning? The responses to this question support the high-stakes testing theme and sub-themes found in the interview transcripts. The repetitive phrases in the participants responses include: limitations of the Biology EOC, the desire to have more freedom to teach topics students are interested in, the need for more inquiry, improved access to technology, better prepared students, improvement of pre-service teachers, more required writing, better methods to deliver instruction and the benefits of professional learning communities (see table 5).

Table 5

Identified Needs to Improve for Teaching and Learning

Partici- pants	EOC	More Free- dom	More Inqui- ry	Access to Tech- nology	Stud- ent Prep- aration	Teach- Prep- aration	Writ- ing	Better Meth- ods	PLC
Teresa	√	√	√	√	√				
Stepha-	√	√	√		√				
Alice	√				√			√	√
Sean	√			√		√			√
Jenn-	√	√	√		√	√			
Kiera	√	√	√	√	√	√			
Walt	√		√		√			√	√
Grant	√						√		
Lacey	√	√	√	√	√	√		√	
Katie	√			√	√				√
Melin-	√	√			√				
Karen	√	√	√			√		√	√

Questions 2: How do Biology teachers use the NCPTS to guide teaching and learning? The interview transcripts indicate five teachers do not use the NCPTS as a guide to improve teaching and learning. Seven participants associate the NCPTS in the context of the Teacher Evaluation Process. They are more familiar with the Teacher Evaluation Process

than the NCPTS. Walt is the only participant that acknowledges he uses the NCPTS to improve his teaching for student learning (see Table 6).

Table 6

Use of the NCPTS to Guide Teaching and Learning

Participants	Does not use NCPTS	Uses the NCPTS	Teacher Evaluation Process
Teresa			√
Stephanie			√
Alice			√
Sean	√		
Jennifer			√
Kiera			√
Walt		√	
Grant	√		
Lacey	√		
Katie	√		
Melinda	√		
Karen			√

Question 3: Which leadership opportunities are Biology teachers aware of and involved with? Participants were asked to discuss the leadership activities they are involved with (see Table 7). Only one teacher is a department chair. Three teachers are chairs of their Biology PLC. Only two teachers are members of their School Improvement Team (SIP), and one of the lateral entry teachers said she didn't want to be on the SIP team. Most of the leadership opportunities came from activities within the school, such as club sponsors, prom committee, or other school-related committees. Three teachers are involved with leadership activities outside of the school. This included being a member of a university public school partnership PLC, North Carolina Science Leadership Association Board Member, and one teacher is a leader on the national level. Her leadership opportunities came from helping the school get started and presenting at conferences.

Table 7

Leadership Opportunities

Participants	Dept. Chair	PLC Chair	School Improvement Team	Within the School	Outside of School
Teresa	√	√			
Stephanie				√	
Alice				√	
Sean				√	√
Jennifer				√	
Kiera			√	√	√
Walt		√			√
Grant		√		√	
Lacey				√	
Katie					√
Melinda			√		√
Karen				√	

Question 4: How do Biology teachers establish a respectful environment for a diverse population? Participants were asked how they establish a respectful environment for a diverse population (see Table 8). It didn't take long for most of the participants to answer. Some of the teachers with less racial diversity in their classrooms, talked about differentiation for learning styles or economic diversity. One of the participants, who adopted an Asian child from another country said, "I am more aware of the things people say that are insensitive to other races now that my son is in school. Some of the things his teachers have said were hurtful, but I don't think they meant to hurt him." Walt is the only participant that says he includes cultural diversity in his lessons. Karen said she uses worksheets with diverse names and pictures, and she talks about pop culture with her students. Several participants believe relationship with students is a key practice for establishing a respectful environment.

Table 8

Establish a Respectful Environment for a Diverse Population

Participants	Key Responses
Teresa	Provide an environment where students feel comfortable
Stephanie	Learn to pronounce their names, let kids know I like them
Alice	A good teacher automatically does it, teach topics in multiple ways
Sean	Kid with students to build rapport, tell funny stories about himself
Jennifer	Makes students work in groups every day, allows them to be individuals
Kiera	Respects students at all times, then you will get respect from them
Walt	Include as many different cultural things as I can in my lessons
Grant	Assumes all students can learn, treat them like they are all going to work, college, or military
Lacey	Practice respectful conversations
Katie	Students work together in different groups
Melinda	Build relationships with students, Be respectful of them
Karen	Worksheets have diverse names and relate to them about pop culture

Question 5: Which curriculum and instruction resources are available and being used? Participants were asked about the curriculum and instruction resources they use with their students (see Table 9). One teacher mentioned the NSES, no one knew about *How People Learn*, and one teacher mentioned the Biology Support Documents that accompany the Biology SCOS. None of the teachers knew about the K-12 Science Curriculum Units, which utilizes Revised Blooms Taxonomy (RBT) to help teachers provide more opportunities for rigor and higher level thinking. Kiera talked about the supplemental reading resources she requires her students to read. Three teachers said they use the SASinSchool Curriculum Pathways (SAS Institute Inc., 2011), a web based interactive science program that corresponds to the NC Biology SCOS. This material was developed by the SAS Institute for teachers to use with their students. Most of the teachers didn't know about this resource. All of the participants discussed something they have found on the internet to use with their students such as web quests.

Question 6: How do Biology teachers make instruction relevant for students?

Participants were asked to discuss how they make Biology relevant for their students. This question had the least response from teachers (see Table 10). Younger teachers played up their knowledge of popular culture. Biology teachers have the advantage of being able to talk about sex and body parts, which always gets students' attention. Only one teacher mentioned using the news. Three teachers mentioned health, and two of these are in small school initiatives where Health Occupations is the focus of the school. Only one teacher utilizes community resources by bringing in guest speakers. Four teachers discussed the importance of fostering relationships with students. Teresa acknowledged during her interview that she doesn't do a good job of providing relevance. She blames having little freedom to choose what students want to do and high-stakes tests for not having the time to find relevant topics to engage students with the curriculum. Grant uses guest speakers to help students make the connections between the classroom and the world of work.

Table 10

Relevance

Participants	Pop Culture	Repro- DUCTION	Current Events	Health	Guest Speakers	Relationship
Teresa		√		√		
Stephanie	√	√				
Alice		√				
Sean						√
Jennifer	√					
Kiera				√		√
Walt						√
Grant					√	
Lacey			√			√
Katie	√					
Melinda				√		
Karen	√	√				

Question 7: How are Biology teachers assessing student learning? Participants were asked to discuss how they assess students (see Table 11). Everyone listed the typical responses for tests, quizzes, homework, labs, and common assessments. Seven teachers mentioned some of the formative assessments they use, but this appears to be limited to a few strategies instead of planned strategies for the students to know if they have learned the

material. Only one teacher uses Classroom Performance System, often referred to as “clickers.” Although Alice and Lacey have a set, they don’t know how to use them and/or the software to use them is not installed on their computer.

Table 11

Assessments

Partici- pants	Forma- -tive & Rubric	Cli- cker	Google Forms	Class - Scape	SCASS & WWW	Re- lease EOC	Vo- cab	Labs Quiz HW	Pro- blem Based Learn
Teresa								√	
Stephanie	√							√	
Alice	√				√	√		√	
Sean	√				√			√	
Jennifer	√							√	
Kiera	√					√		√	√
Walt	√	√						√	
Grant								√	
Lacey								√	
Katie	√		√		√			√	
Melinda	√							√	
Karen			√			√	√	√	

Two teachers discussed using Google Forms and Google Surveys that are free for teachers to use. Class Scapes is an online assessment resource, which NC has made available for school systems to purchase access. These questions follow the same format and content that is used for the EOC. One teacher mentioned that he uses SCASS, another online assessment resource for students. NC pays a yearly subscription fee for all NC science teachers to use SCASS with their students. Three teachers mentioned using the released EOC questions. Only Karen discussed using a vocabulary test. Only Kiera uses problem-based learning.

Question 8: How do Biology teachers use the NCPTS to guide their professional development? Participants were asked if they use the NCPTS to guide their professional development (see Table 12). No one indicated that they are using the NCPTS to guide their professional development, which is necessary to maintain a teaching license. Six teachers use the Teacher Evaluation Process to help them choose professional development opportunities. Six teachers confessed that they do not use the NCPTS or the Teacher Evaluation Process. Most of the participants use whatever the school system offers their teachers for professional development, although teachers complete their on Individual Growth Plans that require signatures of their school administrators.

Table 12

Use of the NCPTS to Guide Professional Development

Participants	NCPTS	Teacher Evaluation Process	Does not use NCPTS	Relies on the School or System
Teresa		√	√	
Stephanie		√	√	
Alice		√	√	
Sean			√	
Jennifer		√	√	
Kiera		√		
Walt		√		
Grant			√	
Lacey			√	
Katie			√	
Melinda			√	
Karen			√	√

Question 9: How and what resources do Biology teachers use to reflect upon their practice? Participants were asked what resources they use to reflect on their practice (see Table 13). Only Kiera mentioned the NCPTS. Jennifer spent a week at the North Carolina Center for the Advancement of Teaching in Cullowhee. She attended a special program for teachers with less than three years of experience. The sessions guided her self-reflection for the things she has done well, and areas to improve. Six participants use their Professional Learning Communities to reflect. This category indicates one of the recent successes of school districts implementation of PLCs for high-stakes tested classes.

Eight participants use their EOC data to reflect. Two of the participants were teaching Biology for the first time, at the time of this study. Only three participants use EVAAS data for reflection. SAS EVAAS (Education Value-Added Assessment System) utilizes a number of different statistical models to provide analytical services, including value-added modeling and projection analyses, that can be used to accurately assess school effectiveness at the district, school or classroom level (North Carolina Department of Public Instruction, 2011). Seven teachers discussed how they use other teachers to help them reflect. Three of the younger participants wished they had another female science teacher to reflect with. These teachers are in a science department with older men, and they found it difficult to be reflective without another female.

Table 13

Reflection

Partici- Pants	NCPTS	NCCAT	Other Teachers	PLC	Teacher Evaluation Process	EOC/Test Data	EVAAS
Teresa				√		√	
Stephanie				√			
Alice						√	√
Sean			√	√		√	√
Jennifer		√	√		√		
Kiera	√		√	√	√	√	
Walt			√		√	√	
Grant				√		√	√
Lacey			√				
Katie			√				
Melinda			√			√	
Karen				√		√	

Question 10: What type of Professional Development for the Implementation of the Use of the NCPTS and TEP did you receive? Few participants recognized the NCPTS by this name (see table 14). Some of the teachers began talking about the new Essential Standards for Biology, or thought I was referring to the Biology SCOS. The Teachers who received the most professional development were the ones that understood the interview was about the NCPTS. All teachers received a paper copy of the NCPTS in 2007 in addition to it being made available on the NCDPI website. Administrators referred to the TEP instead of placing an emphasis on the NCPTS. Experienced teachers received their professional development from their school administrator. Beginning teachers and new teachers in a school system received the information at the teacher orientation provided by central office administrators.

Comparison of Responses by Licensure.

Career Status Teachers. Walt remembered he, and his colleagues were introduced to the TEP on an early release day. Walt said, “They told us, you’re going to be evaluated with this document, and you will need to do a self-evaluation. Then we’ll do the summative based on your self-evaluation, and that was about it.” Teresa, Sean, and Grant didn’t realize I was asking them about the NCPTS. They thought I was referring to Essential Standards or the Common Core that the nation’s governors have endorsed. They knew what I meant when I mentioned the TEP. Career Status Teachers have a continuing license, which is renewed every five years. Career Status Teachers will be evaluated with the TEP every five years when they renew their license.

Initially Licensed Teachers. Lacey, a first-year ILT remembered the supervising teacher from the university used it during her student teaching. Lacey also received the information about the NCPTS and TEP during the school district's new teacher induction when she began teaching this year. Lacey said, "There were so many things to remember during the orientation, it's hard to remember everything." Alice was also introduced to the TEP during the new teacher induction at the central office. She said, "It was on the agenda and they kind of threw it at us and said this is what the school does; so we didn't get a lot of insight or knowledge about it."

Melinda has had the most professional development with the NCPTS and TEP. She was also more at ease when we began, and continued with the interview. She attended a week of professional development for the NCPTS and TEP with the NC Teacher Academy. The NC Teacher Academy was established by the General Assembly in 1993, and the first sessions were held in 1994, at ten colleges and universities across the state as five-day residential academies. The NC Teacher Academy is an agency of the NC State Board of Education (Baker, 2008). Melinda shared that her aunt is a principal in the same school system, and her aunt told her that it was left to the principals to provide teachers with the information about the TEP.

Lateral Entry Teachers. Jennifer's school system also introduced the NCPTS and TEP during their new teacher orientation/induction. She said, "They went through the rubric for the TEP and told us this is how we will be assessed." Karen is a teacher in a low-performing school, and her principal provided the most professional development for the NCPTS and TEP. She said, "On several early release days throughout the year we had long

meetings looking at the document, and we are all very familiar with it.” She also said, “Teachers are given a copy of what administrators are looking for during the observation, and we can look back at our past observation, so we can be sure we get those points for the things we haven’t demonstrated yet.”

Kiera’s school provided a whole day of professional development for the TEP. She said, “it was highly emphasized, and I remember hearing it several times that this is a growth model, and you are not going to come in at distinguished, so don’t expect it.” Stephanie was employed before the NCPTS, and TEP were implemented in her district. She and Teresa are in the same school, and they only received the information at a meeting after school. Last year was their principal’s first year at the school.

Table 14

Professional Development to actuate the use of the NCPTS and TEP

Participants	Faculty meeting after school	Work Day or Early Release Day	Teacher Academy	University Supervisor for student teaching	New Teacher Induction with School District
Teresa	√				
Stephanie	√				
Alice					√
Sean	√				
Jennifer					√
Kiera		√			
Walt		√			
Grant	√				
Lacey				√	√
Katie	√				
Melinda			√		
Karen		√			

Awareness of the NCPTS as a Separate Document from the TEP

The failure of participants' to recognize the NCPTS as a separate document from the TEP generated the data for Table 15. Only one participant recognized the terminology, seven

participants recognized it in context of the TEP, and four participants needed further prompting. Several participants thought I was referring to the Biology Essential Standards, which will replace the Biology SCOS for the school year 2012-2013 (see Table 15).

Table 15

Teachers' Awareness of the NCPTS as a Separate Document

Participants	Knowledge of NCPTS	Only in Context of Teacher Evaluation Process	Needed prompting
Teresa		√	
Stephanie		√	
Alice		√	
Sean			√
Jennifer		√	
Kiera		√	
Walt		√	
Grant			√
Lacey			√
Katie		√	
Melinda	√		
Karen			√

Summary

Summary of the Primary Research Question. At the beginning of each interview the primary research question was presented in the written copy of consent that each participant received. As we began the interview process with questions, it became apparent that four of the twelve participants didn't understand the purpose of the interview. Three participants thought I was referring to the new Biology Essential Standards, which have been adopted and will be in place for the 2012-2013 school year. One participant thought I was referring to the Biology Standard Course of Study, which we are currently using. Seven participants see the NCPTS as the TEP, which is used for their evaluation. They do not associate the NCPTS as a stand-alone document to improve teaching and learning. Only one participant, who spent a week of professional development with Teacher Academy recognized the NCPTS without the connotations of TEP (see Table 15).

Summary of the Secondary Research Questions. Four themes emerged from the interview data of NC teachers' perceptions of the usefulness of the NCPTS to guide teaching and learning. The themes of high-stakes testing, time, funding, and Teacher Evaluation Process were identified and discussed. The *high-stakes testing theme* included the Biology Standard Course of Study and the Biology End of Course Exam. Participants believe the SCOS leaves them little freedom to teach topics that are not listed in the SCOS. They expressed disappointment that certain topics such as animals are limited to a few organisms. They think students would be more interested if they had the freedom to include topics they cared about, more time for inquiry, more current events, and time to do debates. The End of Course exam is limited to multiple-choice questions and participants thought this limited the

curriculum and lessened student interest in Biology. Most of the participants were unaware of the Revised Bloom's Taxonomy K-12 Science Units, which are based on the Biology SCOS.

The time theme can be summarized with "not enough time." Participants feel they do not have time to teach a rigorous Biology SCOS. Some believe it should be taught in as a year-long block scheduled class. Others want more time to go into topics students are interested in that they believe will help students have a better appreciation of Biology. Participants feel the pinch to find time to find resources, including; internet sources, guest speakers, and relevance to help students like Biology. They want more time and access to technology to meet the demands of the goal for 21st century learners. They need more time to set up labs, order supplies, and find labs that are engaging for their students.

The technology theme is the third theme of this study because participants not only wanted more time to find internet resources; they also needed more computers in their classroom via a mobile cart or access to more computer labs. Most of the participants have a projector. They are held accountable for high-stakes testing, and yet they do not all have equal access to technology for a variety of reasons. They are not using cell phones or other technology instruments to engage the learner, and they have limited access to technology that can be used for formative assessments.

The funding theme is really the lack of money available for teachers to buy the necessary equipment and repairs, consumable lab supplies, materials they need for activities, and technology, including computers and probe ware. There has been a loss of funding for teachers' professional development opportunities offered by the school and other

opportunities, which are a consequence of the state current and on-going budget crisis. This has caused class rolls to increase and fewer funds available for education.

Finally, the TEP theme is a theme because participants talked about it throughout the interview. It was not a specific question in the study, but it was intertwined in the participants' responses to the interview questions. This included the professional development they received in preparation for being evaluated with the TEP. Some received a one shot after school with little more than this is how you're going to be evaluated to one participant spending a week at the Teacher Academy. Most of the participants think it is better than the previous evaluation instrument, but they think it takes too much time to "check the boxes" and they want administrators to have more time to sit down with them as the instructional leader of the school and help them grow professionally. Surprisingly, one of the participants wanted to "fly under the radar" because she didn't want to have to do all the paperwork that is necessary to be a distinguished teacher. Most of the participants credited the evaluation instrument with doing a better job of capturing them as a teacher.

Chapter 5

Analysis

Introduction

The unifying synthesis of this study is the phenomenological experience of high school Biology teachers who have been involved with the initial phases of the implementation of the NCPTS. A phenomenological research design was used to describe the experiences of career status, initially licensed, and lateral entry high school Biology teachers in an effort to understand their perceptions of the NCPTS in a high-stakes testing environment. Phenomenology emphasizes a focus on people's subjective experiences and interpretations of the world (Lincoln & Guba, 1985).

North Carolina implemented the NCPTS and Teacher Evaluation Process over a three- year period, beginning in the fall of 2008. Phase I started with 13 school districts, another 22 school districts in 2009 as Phase II, and the remaining school systems implemented the NCPTS and Teacher Evaluation Process as Phase III in 2010. This cadre of teachers represents the broader population of teachers who have been confronted with a new vision of teaching and learning and evaluated accordingly based upon these standards.

Research Questions

The primary research question is: What are high school Biology teachers' perceptions of the NCPTS as a tool to improve their teaching and student learning in a high-stakes testing

environment? The secondary questions include:

1. How do Biology teachers perceive the need to improve teaching and learning?
2. How do Biology teachers use the NCPTS to guide teaching and learning?
3. Which leadership opportunities are Biology teachers aware of and involved with?
4. How do Biology teachers establish a respectful environment for a diverse population?
5. Which curriculum and instruction resources are available and being used?
6. How do Biology teachers make instruction relevant for students?
7. How are Biology teachers assessing student learning?
8. How do Biology teachers use the NCPTS to guide their professional development?
9. How and what resources do Biology teachers use to reflect upon their practice?

In this chapter, a brief overview of the findings from this study is provided. The four themes that emerged during the analysis of the data include; high-stakes testing, time, funding, and the NCPTS and Teacher Evaluation Process. The conceptual framework for this study is drawn from the five standards of the NCPTS. Teachers demonstrate leadership, establish a respectful environment for a diverse population, know the content they teach, facilitate learning for their students, and reflect upon their practices are the five standards, which guided this study. The research that relates to each of the themes, and secondary questions is presented along with the implications from this study. The gaps, limitations, revisiting the conceptual framework and the need for further research are also included in this chapter.

This is the first known study of how teachers are using the North Carolina Professional Teaching Standards. Biology is one of the measures submitted by NC for NCLB (2001), which puts Biology teachers at the forefront of accountability for high-stakes testing in NC. Biology was chosen because everyone must earn credit for Biology in order to graduate from NC high schools. Exemplary science teaching has been investigated in a number of studies, including; *The Search for Excellence in Science Teaching* (Penick et al., 1986), *National Science Education Standards* (National Research Council, 1996), and *How People Learn* (Bransford et al., 2000). The NCPTS are grounded in these best practices that are available for Biology teachers to use.

Analysis of the Primary Question

The primary research question is: What are high school Biology teachers' perceptions of the NCPTS as a tool to improve their teaching and student learning in a high-stakes testing environment? This overarching question led to the development of the probing secondary questions, which were easier for participants to answer. Participants found it difficult to identify the NCPTS as a stand-alone document that can be used as a guide to improve teaching and learning. Only one teacher indicated she understood this document. This participant spent a week of professional development with NC Teacher Academy. Seven of the participants view the NCPTS in the context with the Teacher Evaluation Process. Their responses to the questions were framed in their experiences of being evaluated. None of their responses for the secondary questions indicated they see the standards as a stand-alone document to guide teaching and learning. Four of the participants needed prompting at the beginning of the interview. They thought the interview was about the new Biology Essential

Standards, although the invitational email identified the purpose of the research was for the NCPTS.

Their responses illustrate a basic misunderstanding of the value and benefits of the NCPTS, and its grounding in the research of best practices. The failure of participants' recognition of the NCPTS without the accompanying Teacher Evaluation Process may lead to negative connotations of the NCPTS. When teachers receive a lower evaluation than they expected, they may see the NCPTS as unachievable. The more lofty aspirations of the NCPTS as a goal for all teachers to achieve may fall by the wayside as other initiatives NC has implemented in the past. For the NCPTS to have a positive effect on teaching and learning, teachers need more professional development to help them understand the history and usefulness of these standards.

Analysis of Themes

During the process of collecting and analyzing data from this study, themes began to emerge. These themes include; the pressure of high-stakes testing, the lack of time teachers' experience in the day to day act of teaching, lack of funding for books, technology and lab supplies, and their experiences with the Teacher Evaluation Process (TEP), which is the evaluation of the teachers' implementation of the NCPTS. Analysis of the themes is presented in descending order for the number of times the participants reiterated these repetitive themes during their interview.

High-Stakes Testing Theme. Participants' responses to the first question about what they believe needs to improve for teaching and learning generated the most responses about high-stakes testing. Only two participants didn't mention the EOC until they responded to the

question about assessments. Ten of the twelve participants believe the EOC has been detrimental to the love of science and the role of inquiry in science education. Participants believe that high-stakes testing has led to teaching to the test. They believe our students' inability to think critically and creatively will have a negative impact on our nation's ability to remain competitive in a global market.

This is similar to what Jones et al. (1999) found in their study as well as Ryan (2009) who also found this to be a consequence of high-stakes testing. A one size fits all curriculum often ignores the local contexts relevant to students' lives, discourages student engagement, and works against a deep and lasting understanding of what is being taught (Au, 2011). North Carolina has used the Biology End of Course Exam as a measure of accountability for 25 years, long before No Child Left Behind (2001). Nichols et al. (2006) reported the negative impacts of high-stakes testing on minority students, who have increased retention and dropout rates.

Jennifer, an ILT from a midsize suburban area described the similar experiences her minority students were having with the demands of high-stakes testing. Teresa and Sean were questioned the fairness the EOC is having on exceptional children, and all of the participants describe the negative impacts that the EOC is having on their curriculum and instruction. Lomax et al. (1995) and Wells (2010) have reported the negative effects that high-stakes testing is having on exceptional children.

Tucker (2009) found a correlation between high-stakes testing and teacher burnout in public high school teachers. This phenomenon may help explain why there is a shortage of highly qualified Biology teachers in North Carolina. Jennifer said she is planning to leave the

teaching profession because she has classroom management issues, lacks a supportive administration, and camaraderie in the science department. Grant's impending move to administration removes him from the stress of teaching Biology. Teresa is looking forward to retirement next year, so she can escape the pressure of high-stakes testing. Stephanie would rather teach Earth/Environmental Science for this reason. Karen is planning to teach one more year, which will pay off her student loans, and she can be a stay at home mom.

Time Theme. Time was mentioned by all the teachers at some point during their interviews. It was used the most when participants said they didn't have time to do inquiry. Inquiry is an essential skill that is emphasized in the NSES (National Research Council, 1996) and NBPTS (National Board for Professional Teaching Standards, 2010b). They also bemoaned the fact that their students were arriving unprepared for Biology. Connecting to prior knowledge is one of the essential best practices in *How People Learn* (Bransford et al., 2000). Nine of the participants complained about students' lack of prior knowledge. This makes it difficult to move into the more abstract concepts in Biology if students lack the more basic concepts to build upon.

Eleven of the Biology teachers in this study identified the lack of student motivation as a problem that they believe is exacerbated by the feeling of not having enough time to do engaging activities. Penick (1989) reported the need for issues based science education to engage students. Amrein and Berliner (2003) studied 18 states, which included North Carolina, and found high-stakes testing decreased student motivation. Their study also found it has a negative impact students' love of learning. Teresa, Walt, Stephanie, Jennifer, Karen,

and Kristin are concerned about their students' negative attitudes and disinterest in science, which was reported by Jones et al. (1999).

Inquiry is the heart of science, and participants in this study have admitted they have sacrificed this basic premise of discovery because they don't believe they have time for student inquiry (Penick et al., 1986; American Association for the Advancement of Science, 1989; Wise, 1996; Bransford et al., 2000; Anderson et al., 2001; Alouf & Bentley, 2003; Bybee et al. 2006; Akkus, Gunel, & Hand, 2007; Kraus, 2009). Participants in this study identified the lack of time to do inquiry-based learning because of the stress of high-stakes testing.

Several studies have reported the negative effects high-stakes testing has had on inquiry in science class (Wideen et al., 1997; Barksdale-Ladd & Thomas, 2000; Westerlund et al., 2002). Inquiry takes time, which may leave less time for other goals and objectives in the Biology SCOS. These participants feel the pressure of high-stakes testing and not enough time to cover the SCOS as the primary reason for not using in inquiry and variety of instructional approaches. The results from this study are similar to the results reported in other studies (Lomax et al., 1995; Wideen et al.; Jones et al., 1999; Westerlund et al.; Katzmann, 2008)

It is unfortunate that the Biology EOC data was selected by NC educators to be part of the data set submitted for NCLB. All students in NC must earn a course credit for Biology to receive a high school diploma. Since this requirement was already in place, this data was readily available for NCLB. Inquiry based instruction requires teachers to do more than

traditional teacher-centered instruction. It may be easier for teachers to blame high-stakes testing and resist changing to student-centered instruction.

Funding Theme. The participants in this study identified the lack of funding as a major issue they face due to the state's budget crisis. Participants described how it has impacted the cleaning and maintenance of microscopes, supplies for hand-on learning activities, lab consumable supplies, and technology. The North Carolina State Board of Education has mandated that teachers provide opportunities for 21st century learning, but several teachers in this study do not have some of the basic equipment many educators are beginning to take for granted. This includes a data projector and computer with internet access, and computers for students to use in their classrooms. This appears to be one of the largest disparities among the participants in this study.

All the teachers have a desk-top computer where they can do attendance and emails, but everyone doesn't have a data projector. Three of the participants teach in schools that received the Golden Leaf Foundation (2011) grant, which was used to purchase lab top computers for every student in the school. Karen share with me, that people from Golden Leaf were not happy with how their students are handling their lap tops. Some of the students have lap tops with broken screens and hinges. Another participant expressed his frustration that his school only has two computer labs for 1,500 students. This range is indicative of the disparity of access to technology in our state's public schools.

There are a range of studies about the effects of technology on student achievement. The benefit of using technology to engage digital natives and prepare them for the 21st century workplace is reflected in the NCPTS. With funding as a continuing issue facing

schools the study by Angle (2011) answers an important question about its effect on student achievement. The overall findings of this study indicate the utilization of educational technology resources were supportive of the efforts to raise student achievement. Data projectors and document cameras were the most effective hardware resources for increasing student achievement, followed closely by high-speed internet connectivity and wireless internet connectivity.

Hands-on learning requires funding (American Association for the Advancement of Science/Project 2061, 1993; National Research Council, 1996). These funds are used for equipment and consumables. The participants in this study indicated the need for funds to replace broken and worn out equipment. Technology has had a tremendous impact on our ability to access, process, and understand data generated in laboratory settings (Angle, 2011). There are various grants available for teachers and schools to utilize. However, it requires time to find the grant sources and complete the grant application. If we believe science achievement is important for our society, we as citizens need to find ways to provide these opportunities for our students (American Association for the Advancement of Science, 1989).

The state's budget crisis has had a negative impact on the purchasing of science textbooks. The Biology textbooks currently being used were purchased in 2005. These books were selected for the list state adopted textbook in 2004, which means they were already published prior to 2004. Some in our society call for the end of textbooks, and instead use the web-based resources. While this is true, the problem of equitable access to technology

remains a problem for some of the schools in this study. Walt and Lacey both complained about the lack of adequate access to computers for student-centered activities.

Grant was disgusted with his school district because they had spent considerable funds for poorly constructed test items they used for benchmark assessments. He was upset because the funds could have been used for much-needed laboratory supplies. The participants with more experience remember when they had enough funds to purchase laboratory supplies. Katie graduated from the high school where she now teaches. She remembers all the labs she did as a student, and now she cannot purchase the things she needs to do it for her own students.

NCPTS and TEP Theme. The participants in this study have identified some of the weaknesses in implementation of the NCPTS and TEP. Only one teacher recognized the terminology of the North Carolina Professional Teaching Standards. She attended a five day professional development with the NC Teacher Academy. Most of the teachers recognized the Teacher Evaluation Process. Four of the participants still couldn't make the connection between the NCPTS or TEP. Two are career status teachers who have not been directly involved since the implementation of the TEP includes initially licensed, lateral entry, and career status teachers who are renewing their teaching license every five years. One ILT had difficulty recognizing the NCPTS and TEP. She had only been teaching for a couple of months, and she had not been observed by the principal prior to her interview for this study. However, later in the interview she remembered her supervising teacher for student teaching had gone over the NCPTS and TEP with her. She also remembered it was mentioned during the school district's teacher induction at the central office.

This study of Biology teachers' perceptions of the NCPTS in an era of high-stakes testing illustrate the need for teachers to have a better understanding of the research from *How People Learn* (Bransford et al., 2000), the *BSCS 5 E* lesson plan (Bybee et al., 2006), *National Science Education Standards* (National Research Council, 1996), and *Taxonomy of Learning* (Anderson et al., 2001), which describes Revised Bloom's Taxonomy and how to implement higher-level thinking. These participants did not indicate they utilize connecting to prior knowledge or student metacognition from *How People Learn* or Revised Bloom's Taxonomy. Most of the participants said the Biology SCOS and high-stakes testing didn't allow enough time to do inquiry, as prescribed in the *NSES* or *Search for Excellence in Science Teaching* (Penick & Yager, 1983).

The findings of the study illustrate the need for further professional development for teachers to utilize the NCPTS. Melinda recognized the terminology of the standards, but her answers to the secondary questions did not demonstrate any depth of knowledge of them. Two participants confessed they either looked at the NCPTS or asked a peer about them on the day of the interview. Most of the participants in this study were not able to identify the NCPTS as the standards for teaching; instead they associate it with the Teacher Evaluation Process. Kiera articulated and demonstrated her understanding of the standards, but it was from the context of the TEP.

The leadership of Kiera's school has provided a structure, which has enabled teachers to build relationship with students. This is one of the philosophies of the Small Schools Initiative. Kiera knows the content she teaches. She provides students with multiple opportunities to demonstrate their learning with formative assessments practices, problem-

based learning, and using alternative curriculum and resources for instruction. she was also the most reflective about her practice. She is the poster child for the NCPTS, and she entered the profession as a lateral entry teacher. She was able to apply the theory she learned in her education classes for certification with her students.

Comparison of Career Status, Initially Licensed and Lateral Entry Teachers

The career status teachers were comfortable in their role as a teacher; they were reflective about the changes that have occurred in education over the past several years. Teresa remembers what it was like to teach before the era of high-stakes testing, and she misses the freedom to make her own decisions about what and how long something needed to be taught. Although the more experienced teachers have had more opportunities for leadership, her administrator identified the need for her to assume a more active role leadership role.

The three groups of participants did not reveal tremendous differences in the approach for the standard to establish a respectful environment for a diverse population. Most of the participants in each group identified the importance of relationship with students, which enables them to have rapport with all groups of students. There was not a noticeable difference between the three groups approach to assessment. Some from each group of participants are using or not using formative assessments. This study supports the need for the use of NC FALCON (North Carolina Department of Public Instruction Accountability Services Division, 2011), which is an online professional development for NC educators to understand the need and implementation of formative assessment strategies. A few of the

teachers were aware of the *Formative Assessments* by Keeley (2008), but most of the teachers had a limited understanding of this important tool for education.

All the participants identified the need for the Biology EOC to be changed. They believe it requires too much factual knowledge. The new Biology Essential Standards reduces some of the content and utilizes a more conceptually based approach (North Carolina Department of Public Instruction Accountability Services Division, 2009b). The Biology EOC will reflect these changes (North Carolina Department of Public Instruction Accountability Services Division, 2009a), and the goals and objectives will require higher-level thinking that is reflected in Revised Bloom's Taxonomy (Anderson et al., 2001). Kiera's interview and EOC performance data (Education First NC School Report Cards, 2009) indicates she has already implemented these strategies and should have no difficulty with the new Biology Essential Standards and EOC assessment.

Ten of the participants admitted they are not using the standards to guide their professional development or use it to help them reflect upon their practice. In fact, all three of the initially licensed teachers said they don't use the NCPTS. Walt, a career status teacher, and Kiera, a lateral entry teacher are the only teachers who said they are using the NCPTS. The lack of time participants gave as an excuse may be the reason these participants are not using curriculum and instruction resources that are available.

The *NSES* and *How People Learn* are available on the internet for free, but they are not being used by the participants. The teachers who have passed, attempted, or waiting on their results for National Board Certification are the only participants who indicated that were aware of the *NSES*. Participants are not using resources that have already been paid for

teachers to use. This includes; SASinSchool, Science SCASS, and the K-12 RBT Science Units. No one mentioned using NC Learn, a free online resource that has lesson plans written by NC teachers that are aligned with the state's Standard Courses of Study.

The initially licensed and lateral entry teachers in this study have entered the NC teaching profession since Biology textbooks were purchased seven years ago. These teachers do not have books for all of their students to have an assigned book. Most of these teachers do not even have a class set of books for everyone to use during class. Two of the participants are in schools that received a grant to purchase laptops for every student. Two of the participants are in small school initiatives, which provided laptops for every student. Several participants complained they have to police students while they are using computers. Students are distracted from the Biology lesson because they are listening to music, on Facebook, or other web sites they should not be using.

The availability of technology in the schools that didn't have a laptop for every student, ranged from one computer lab with 27 computers for 1,100 students, two computer labs for 1,600 students, and one school that had so many computer labs the teacher wasn't sure how many labs were in the school. She also said they have several mobile laptop carts. What makes this so bewildering is the school with 27 computers for 1,100 is in the same school district.

Relevance was also a large disparity between what the NCPTS expects and what is actually occurring in classrooms. Other than Kiera, all the teachers need professional development to learn how to incorporate more relevance for students to understand how what

they are learning applies to them. There was no clear difference between the three groups of participants and their responses to this question, except Kiera.

Study Limitations

A limitation of this study may be the selection of participants, which were limited to school districts that were the first to implement the NCPTS and TEP. The implementation of the NCPTS and TEP over a three-year period, and beginning with only 13 school districts limited the number of Biology teachers eligible to participate in this study. Due to the difficulty of finding initially-licensed and lateral entry teachers in Phase I school districts, it was necessary to include four teachers from Phase II school systems. Two participants from Phase II were initially licensed teachers, and two participants were career status teachers.

None of the participants teach in currently low-performing schools, although four of the schools had to utilize lateral-entry teachers when these teachers were hired. It was difficult to find initially licensed and lateral entry Biology teachers in the school districts involved with Phase I, which made it necessary to utilize the participants from school districts implementing the NCPTS and TEP in Phase II. I have to the best of my ability reduced the bias and limitations, which have been addressed in Chapter 3. However, these factors may have had an influence on how I interpreted the data.

Study Implications

The findings in this study may provide an opportunity for school administrators and NCDPI Division of Teacher Recruitment and Retention to implement a more rigorous professional development and support for the vision to become a reality. It may also provide an opportunity for teachers to realize they need to provide more relevance for students to

understand how Biology connects to the world. This study identified the need for teachers to have a better understanding of summative and formative assessments. The Blue Ribbon Commission (North Carolina Department of Public Instruction Accountability Services Division, 2009a) has established a framework for change to improve accountability in North Carolina. One of the changes in 2012-2013 will be new assessments that measure higher-level thinking. Although the RBT Science units have been available since 2008, this study revealed few of the teachers know about this resource, which is based on Revised Bloom's Taxonomy from *Taxonomy for Learning* (Anderson et al., 2001). Hopefully, teachers will embrace this change, instead of failure to make the shift from teaching factual knowledge to conceptual knowledge.

A second implication from this study identifies the need for teachers to utilize inquiry, problem solving, relevance, and student-centered instruction to engage and motivate students. A third implication for lower grade teachers and administrators is demonstrated in the need for students to come to high school prepared for Biology. This may be a factor in higher rates of retention and drop out. An implication for everyone is the need for adequate professional development for teachers. They need to understand the basis and how to implement each of the standards. This study illustrated an afternoon after school is not enough time for teachers to grasp the significance of using and being evaluated with the NCPTS and TEP.

This study identified the lack of time school administrators may have to provide feedback to help teachers improve their practice. School administrators are busy with discipline and the day to day operation of the school. Now they must provide the professional

development for a new vision of teaching and learning. Another implication for school administrators is the threat of fidelity for the TEP. One of the participants said she could tell her administrators what she did for a standard without it being observed. This increases the risk of providing teachers with an evaluation they do not deserve. This puts an additional burden on administrator's time, which may impact the quality of instructional feedback teachers deserve from their instructional leader. Research shows educators will find time to implement positive change in their classrooms and schools when transformative leadership stimulates teachers' professional learning and motivation (Thoonen, Sleeper, Oort, Peetsma, & Geijsel, 2011).

An implication for legislatures allocating funds and school administrators managing school funds is the disparity of technology in schools, and lack of funding for science education. Two of the participants are in schools without adequate technology to implement online assessments that will be used next year. Ten of the participants identified the need for adequate funding for laboratory supplies and equipment.

Revisiting the Conceptual Framework

The conceptual framework for this study utilized the existing theory and research from the Search for Excellence in Science Teaching (Penick & Yager, 1983), *The National Science Education Standards* (National Research Council, 1996), *National Board for Professional Teaching Standards* (National Board for Professional Teaching Standards, 2007), *How People Learn* (Bransford et al., 2000), and the *North Carolina Professional Teaching Standards* (North Carolina Professional Teaching Standards Commission, 2006). These historical documents that identify the characteristics of exemplary science teaching,

along with my own experiential knowledge as an experienced high school Biology teacher, National Board Certified Teacher for Science, Mentor Teacher, assistant principal, and NCDPI Science Instructional Coach, along with the primary research question was the conceptual framework and purpose for this study.

The conceptual framework worked well for this investigation. It allowed me to ask practicing teachers what they think of the NCPTS. While my own experience has provided an opportunity to understand the history and importance of the existing theory and research, it also helped me understand the teachers' perspective. Although I wasn't asking specific questions about teachers' time and funding, I understood what they were experiencing. Using this lens helped me identify with the participants, and it allowed me to ask meaningful questions and probe for deeper understanding.

The humanistic theory and social comparison theory were useful theoretical constructs that were identified in earlier in this study. The humanistic theory draws on the work of phenomenology, which focuses on the perspective of the self (Pedretti, Bencze, Hewitt, Perris, & Van Oostveen, 2006). The role of self-esteem and self-actualization are aspects of the humanistic theory, which were evident in the participants' responses. Several teachers said the standards were what good teachers do in their classrooms. Social Comparison theory was applicable for this study because teachers compare themselves to other teachers, although they may or may not aspire to be the best that they can be, as Stephanie pointed out. The NCPTS are an accurate guide teachers can use to improve teaching and student learning. The NCPTS are based on best practices identified in the

Search for Excellence in Science Teaching, NSES, 5 E Lesson Plan, NBPTS, How People Learn, and Taxonomy of Learning.

Upon further reflection about this study and an alternative conceptual framework for a similar future study, three theories for educational organizations proposed by Darling-Hammond, Wise, and Pease (1983) might be worth considering. The three theories are the rationalistic theory, spontaneous theory, and the humanistic theory. The rationalistic theory lens is based on the policy maker and administrator who rationalize the operations of the school. The spontaneous theory places the teacher as the central figure, and the rest of the school serves the purpose of permitting the teacher to give spontaneous expression to foster students' intellectual growth. The humanistic theory places the students as the focus and the school revolves around the needs and interest of students to facilitate their development.

Further Research

High-Stakes testing predominates the lives of these participants, this more than any other issue was brought up at the beginning, during, and closure for all 12 interviews. In the review of the literature, I only found a few studies investigating the effects high-stakes testing is having on high school Biology. There were more studies investigating the effects on elementary, middle, and other high school courses. If the results of this study are indicative of the attitudes and experiences of other NC Biology teachers, there is a need for additional research.

One of the participants in this study would be an excellent source of information for a case study. Kiera is the consummate teacher; she is almost too good to be true. It would be interesting to spend more time with her, observe her in action, and find out how she

developed into an excellent science teacher in a relatively short amount of time. This information would be beneficial for all teachers. Kiera's lack of lab space and microscopes raises all sorts of questions and assumptions for best practices for science education. It would be interesting to investigate how well Kiera's students do on the Biology EOC after the state begins using the new essential standards for Biology and assessment of higher-level thinking.

I thought the less experienced teachers would be the most receptive to the NCPTS, because it would give them something tangible to guide their practice. I was surprised to find so few participants using the NCPTS to improve their practice, guide their professional development, and reflect on their practice. Although the results were not what I expected, the search for themes in the interview transcripts, reminded me of the day to day existence and burden of being a classroom teacher. The feeling of not having enough time is something I remember quite well and it is a real issue that haunts teachers.

Teachers do not have enough time to search for resources, which helped me identify a missing segment in the NCPTS. There is nothing in the standards that specifically identifies teacher collaboration. There are standards for leadership, providing a respectful environment for a diverse population of students, knowledge of content and ways to engage students, and reflection, but nothing about collaborating with other teachers to share ideas and resources. Several participants said they collaborate in the professional learning communities, but a primary focus of the PLC is looking at student data.

This is the first known study of the implementation of the NCPTS and it was limited to only high school Biology teachers. A similar study investigating 5th and 8th grade science

teachers' perceptions of the usefulness of the NCPTS in a high-stakes testing environment would be beneficial to compare with the results of this study.

An investigation of non-EOC or non-EOG teachers perceptions of the usefulness of the NCPTS may identify different strengths and weaknesses for the standards, and teacher evaluation. A longitudinal study investigating the long-term effects the NCPTS have on teaching and learning would be helpful for every teacher and student in the state, and how long it takes for this policy to affect change.

There could be further research investigating how well the NCPTS encourages Biology teachers to utilize inquiry and student-centered instruction. Several of the participants admitted they do not provide enough relevance. A study investigating how much and what types of relevance teachers are providing for students now that it is included in the NCPTS. The NC Teaching Standards Commission has been disbanded and closed, the responsibility for monitoring the NCPTS has been assigned to the NCDPI Educator Recruitment and Development Division (North Carolina Department of Public Instruction Teacher Recruitment and Development Division, 2011), and an investigation of how the NCPTS continue to evolve and meet the needs for students would be a worthy investigation.

This study did not include or exclude participants based on where their school was located. A study that controls for rural, suburban, and urban settings may yield information that could be used to improve the implementation of the NCPTS and TEP. Inadequate funding was a theme in this study, and socioeconomic factors could be investigated further. The SBOE's goal of students being prepared for the 21st century will not be realized without technology resources allocated equally for all schools and their students.

Conclusion

Based on the findings in the study, most of the teachers are not using the NCPTS as a guide to improve teaching and learning. There has not been an adequate amount of professional development about the best practices on which these standards are based. These participants are not using the NCPTS to guide their professional development. They do not see the standards for what they are; they see these standards in connection with the Teacher Evaluation Process. Given this phenomenon, this study indicates the plans to improve education in NC may take longer than the three years that the state has allocated for the NCPTS to be fully implemented.

Findings were grouped in the following four categories: High-Stakes Testing, Time, Funding, and the NCPTS and Teacher Evaluation Process. Critical findings are presented below.

- High-Stakes Testing – teachers perceive the need to change the Biology SCOS and Biology End of Course Exam. There is too much content and the EOC is limited to multiple-choice questions that rely on recall and remembering of factual knowledge.
- Time- teachers perceive the lack of time they need to do adequate lesson planning and find resources. They feel they do not have time to do inquiry with their students or laboratory investigations. Teachers perceive they have not had time to use the NCPTS to improve their practice.
- Funding- Teachers do not have the adequate funds to purchase and maintain the equipment they need for laboratory experiments. They do not have the

funds they need to buy consumables for labs and hands-on learning activities. Sufficient funds are not available in some of the schools to provide computers for students to use 21st-century skills. Some of the teachers do not have data projectors or document cameras to use with their students. The student response systems available for teachers to use for formative and summative assessments are cost prohibitive for some school districts. School districts are spending funds on a variety of test item banks that teachers do not feel are relative to the EOC.

- NCPTS and TEP- Administrators do not have adequate time to spend with each teacher and help them understand what they need to do to become an accomplished educator. Administrator's inconsistent observations of teachers and the inconsistent evaluations serve to undermine the fidelity of the TEP across classrooms, schools, school districts and the state.

This research was limited by the selection process of career status, initially licensed, and lateral entry teachers in school districts involved with implementing the NCPTS in Phase 1. The lack of sufficient numbers of initially licensed and lateral entry teachers in proximity of the university required the use of two initially licensed and lateral entry teachers from school districts involved in Phase 2.

The conceptual framework for this study included the five standards of the NCPTS. This conceptual framework served as a lens to guide this investigation. The results of this study indicate teachers need additional professional development to help teachers understand how the NCPTS can be used to guide teaching and learning. This study identified the need

for school administrators to be consistent with the TEP. The study also identified the need for the school's instructional leaders to guide teachers in the improvement of their practice for teaching and learning.

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Appendix 1

IRB Notice

IRB irb@appstate.edu to campanykh, pacificilc, killackycj

show details Sep 22

To: Kay Campany

CAMPUS MAIL

From: Dr. Stan Aeschleman, Institutional Review Board Chairperson

RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)

Date: 9/22/2011

Study #: 11-0060

Study Title: A Phenomenological Study of North Carolina High School Biology Teachers Perceptions of the North Carolina Professional Teaching Standards in an Era of High-Stakes Testing.

Submission Type: Renewal

Expedited Category: (6) Collection of Data from Recordings made for Research Purposes,(7) Research on Group Characteristics or Behavior, or Surveys, Interviews, etc.

Renewal Date: 9/22/2011

Expiration Date of Approval: 9/20/2012

This request for renewal has been approved by the above Institutional Review Board for the period indicated.

Investigator's Responsibilities:

Federal regulations require that all research be reviewed at least annually. It is the Principal Investigator's responsibility to submit for renewal and obtain approval before the expiration date. You may not continue any research activity beyond the expiration date without IRB approval. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.

You are required to obtain IRB approval for any changes to any aspect of this study before they can be implemented. Should any adverse event or unanticipated problem involving risks to subjects occur it must be reported immediately to the IRB.

CC:

Linda Pacifici, Curriculum And Instruction

Cecil Killacky, Leadership And Edu Studies

Appendix 2

Invitation to participate email

Dear North Carolina HS Biology Teacher

My name is Kay Company, I am a doctoral student at Appalachian State University. This is an invitation to participate in a research study of NC HS Biology teachers' perceptions of the North Carolina Professional Teaching Standards in a high-stakes testing environment. This is the first known study of the effects of the NCPTS on teaching and learning. I am seeking 12 participants, four career status, four initially licensed, and four lateral entry teachers to share their experiences with me during one 60 to 90 minute interview at a time and place that is convenient for you. You will remain anonymous along with your school system. The only identifiable information will be a high school biology teacher who teaches in a school system designated in the Phase 1 implementation of the NCPTS. You will be assigned a fictitious name to protect your identity.

There are no financial rewards, only the intrinsic reward of helping your profession. I plan to conduct interviews this fall, if you are willing or would like additional information, please send an email to kaycompany@gmail.com.

Sincerely, Kay Company, M.A.Ed.,
Doctoral Student Appalachian State University



Appendix 3

Informed Consent

Consent to Participate in Research

Title: A Phenomenological Study of North Carolina High School Biology Teachers Perceptions of the North Carolina Professional Teaching Standards in an Era of High-Stakes Testing

Principal Investigator: Kay Company, Doctoral Program in Educational Leadership
 Contact Information: kaycompany@gmail.com, 255 Northridge Dr., Boone, NC 28607, 828 264-4048 home, 828 963-3474 cell.

Co-Chairs Linda Pacifici, 828 262-3231 pacificilc@appstate.edu, Appalachian State University, 208E Edwin Duncan Hall, Boone, NC 28608

and Jim Killacky 828 262-3168 killackycj@appstate.edu, Appalachian State University, 324A Edwin Duncan Hall, Boone, NC 28608

What is the purpose of this research?

You are being invited to take part anonymously in a research study about high school Biology teachers' perceptions of the North Carolina Professional Teaching Standards (NCPTS) to improve teaching and learning in a high-stakes testing environment. The North Carolina Professional Teaching Standards and North Carolina Teacher Evaluation Process are being implemented over a three year period, with the statewide implementation this year. Currently, NC is experiencing a shortage of licensed teachers with science as the greatest need. School districts must hire teachers who do not have a teaching license and teacher preparation coursework. There are three levels of teacher licensure, career status, initially licensed, and lateral entry. Four teachers for each category will be interviewed.

The NCPTS Commission has set "high and rigorous standards for the teaching profession to ensure that teachers have the skills, knowledge, and experiences necessary to prepare youth to thrive in a complex, dynamic global multicultural society" (NCPTS, 2008). Additionally, High School Biology teachers have the additional stress of state and federal accountability because North Carolina submits high school Biology End of Course results as one of the five measures reported to the federal government as required by the No Child Left Behind Act, and publishes the school End of Course data as part of the NC School Report Card.

This research investigates teachers' perceptions of how the NCPTS are being used by high school Biology teachers to improve teaching and learning. If you take part in this study, you will be one of 12 people to do so. By doing this study we hope to learn if high school Biology teachers find the NCPTS to improve teaching and learning. Is there a difference between how career status, initially licensed, and lateral entry teachers perceive the usefulness of the standards? This is the first known study involving the NCPTS and this research provides an opportunity for you express how these standards are assisting you as a teacher.

There are many research studies of exemplary teaching practices, fewer research studies of the effects of high-stakes testing on teaching, and few research studies of the

effects of high-stakes testing on science teaching. This is the first known study involving the NCPTS, and this research provides an opportunity for high school Biology teachers to share their experiences of using the NCPTS to guide their teaching.

What will I be asked to do?

- The research procedures will be conducted at a place and time that is convenient for you. The total amount of time you will be asked to volunteer for this study will be 60 to 90 minutes.
- You will be asked to answer a set of questions about your experiences with the NCPTS.
- I will use interview notes and the interview will be recorded so I can accurately transcribe the data. All 12 participants will have the opportunity to check their data, ask questions, and participate in a blog, if they choose. Access to the blog will be limited to the 12 participants and me.

What are possible harms or discomforts that I might experience during the research?

- To the best of our knowledge, the risk of harm for participating in this research study is no more than you would experience in everyday life.
- If you choose to participate in the blog, online communication is not perfectly secure.

What are the possible benefits of this research?

- There may be no personal benefit from your participation but the information gained by doing this research may help others in the future.
- This study should help us learn about ways to improve teaching and learning in NC.

Will I be paid for taking part in the research?

- You will not be paid for the time you volunteer while being in this study.

How will you keep my private information confidential?

- Your information will be combined with information from other people taking part in the study. When I write up the study to share it with other researchers, I will write about the combined information. You will not be identified in any published or presented materials.
- This study is anonymous. That means that no one except me will know that the information you gave came from you.
- I will make every effort to prevent anyone who is not on my doctoral dissertation committee from knowing that you gave us information or what that information is.
- You will be assigned a fictitious name to protect the confidentiality of the information. and the school system will only be identified as one of the 13 school systems involved in Phase 1 implementation.

- However, there are some circumstances in which we may have to show your information to other people. We may be required to show information that identifies you to people who need to be sure that we have done the research correctly, such as Appalachian's Institutional Review Board and the research funding agency.
- The audio-recording and interview notes, along with any data from the blog may be kept for up to a year and will be destroyed with shredding and/or erasure of recording. These recordings will not be used for any other purposes than this research.

Who can I contact if I have questions?

The people conducting this study will be available to answer any questions concerning this research, now or in the future.

- You may contact the Kay Company at 828 264-4048 home or 828 963-3474
- If you have questions about your rights as someone taking part in research, contact the Appalachian Institutional Review Board Administrator at 828-262-2130 (days), through email at irb@appstate.edu or at Appalachian State University, Office of Research and Sponsored Programs, IRB Administrator, Boone, NC 28608.

Do I have to participate? What else should I know?

- Your participation in this research is completely voluntary. If you choose not to volunteer, there will be no penalty and you will not lose any benefits or rights you would normally have. If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. There will be no penalty and no loss of benefits or rights if you decide at any time to stop participating in the study.
- This research project has been approved, as required; by the Institutional Review Board of Appalachian State University This study was approved on 9/27/10 This approval will expire on 9/20/12 unless the IRB renews the approval of this research.

I have decided I want to take part in this research. What should I do now?

The person obtaining informed consent will ask you to read the following and if you agree, you should indicate your agreement:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I understand that I can stop taking part in this study at any time.
- I understand I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

Participant's Name (PRINT)

Signature

Date

Appendix 4

The Lay Summary

Thank you for meeting with me today, I appreciate you taking time from your busy schedule. I would like to tape record our meeting, so I won't miss the important details.

1. My name is Kay Company, I have taught Biology for 27 years, and currently I am a doctoral student in Educational Leadership at Appalachian State University.
2. I want to understand how NC High School Biology Teachers perceive the North Carolina Professional Teaching Standards in an era of high-stakes testing. As a teacher in one of the school systems that piloted the implementation of the standards, you have the most experience with the new standards.
3. Your responses will not be shared with anyone in your school system and your responses will be protected with an anonymous name for the study to protect your identity. The group result will be shared with my committee members and other interested educators.
4. Participation is voluntary and you may withdraw from the study at any time. I would like to interview you during your planning period, after school or weekend day that is convenient for you. The meeting will last at least an hour and not longer than an hour and a half.
5. You have my assurance that your name will not be used or the name of your school, or building administrator.
6. We need to meet at least once, we can meet again if you have additional comments you would like to make. You are invited to participate in a blog with other participants to make additional comments.
7. I request that you allow me to make notes or tape record our session.

Appendix 5

Interview Protocol

Thank you for agreeing to meet with me today,

I will be asking you a set of questions today about your experiences with the North Carolina Professional Teaching Standards. You have been using the standards for two years, and I would like to know how these standards have impacted teaching and learning. Our accountability model has been in existence for 15 years and serves as a model for other states. Now we are one of the first states to link teaching standards and student achievement. There has been a significant amount of research about exemplary science teaching over the past several decades. Now, research is beginning to investigate the effects of high-stakes testing, however, it's difficult to find research for the effects of high-stakes testing on science teaching. The purpose of this research is to understand how the NCPTS are impacting teaching and learning in Biology classes with high-stakes testing.

Do you have any questions?

1. Which teaching license do you hold?
 - A. Career Status,
 - B. ILT
 - C. Lateral Entry
2. How long have you been a teacher?
3. Did you receive professional development in preparation for using the NCPTS? How much time
4. How do you perceive the needs to improve teaching and learning? In your classroom, school, state, nation?
5. Which leadership opportunities are you involved with?
6. How do you establish a respectful environment for a diverse population?
7. Which curriculum and instruction resources are available and which ones do you use?
8. How do you make instruction relevant for students?
9. How do you assess student learning?
10. In what ways are you using technology with your students?
11. How are you using the NCPTS to guide your professional development plans?

12. Describe how you reflect on your practice.
13. Is there anything you would like to share that I haven't asked?

Vita

Kay Hudkins Company was born in Bryan, OH. She attended elementary and high school in Clarkesville, GA, and graduated from North Habersham High School in June 1970. In the fall of 1971, she entered Piedmont College, and in November, 1974 she was awarded the Bachelor of Science degree, in Biology. In the fall of 1977, she entered Western Carolina University, and in August, 1980 she was awarded a Master of Arts in Education in Biology, in Two Year College Teaching Biology. In the fall of 2004, she entered Appalachian State University, and in December, 2011 she was awarded the Doctor of Education in Educational Leadership degree.

Dr. Company taught science in the public schools of Savannah/Chatam, Gordon, and Glynn County Schools in GA, and Shelby City, and Avery County Schools in NC. She was also an assistant principal with Avery Schools for three years. Ms. Company has served as a Science Instructional Coach for the North Carolina Department of Public Instruction.

Dr. Company is a member of Phi Kappa Phi and Delta Kappa Gamma. Her parents are the late Roger Hudkins of Clewiston, FL, and Edna C. Elrod of Clarkesville, GA. She is married to Donald Company and they have a son, Courtney, a daughter, Stacy, a son-in-law, Daniel, and grandson, Robert. She and her husband have resided in Boone since 1988.