

FACTORS THAT INFLUENCE THE RETENTION OF SECONDARY
URBAN SCIENCE TEACHERS

by

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(Under the Direction of Deborah J. Tippins)

ABSTRACT

Research suggests that school districts in the United States report that there is a teacher shortage, but the literature indicates that the problem is not a deficit of teachers in general, but a scarcity of teachers in specific areas such as special education, mathematics and science. Recruitment is the method by which these positions are filled, but recruiting teachers solves only half the shortage problem. Retaining current teachers is the other half of the problem, and teacher retention is a problem across the nation. Research indicates that teachers are leaving the profession within three to five years after entrance. Research also indicates that not nearly enough science teachers are being produced from schools of education. Urban schools report low retention rates in all disciplines, and science positions in particular are hard to staff. The literature indicates that school climate, science teacher efficacy and professional development are very influential in the retention of teachers. This investigation was undertaken to see if there is a statistical relationship between these factors and the retention of science teachers in urban schools. A web-based survey called the Science Teacher Retention Factors Instrument (STRFI) was used to collect data from 103 science teachers from four urban districts in the southeastern United States. The

STRFI had three main components: the Organizational Health Survey for Secondary Schools (OHI-S), the Science Teacher Efficacy Beliefs Statement (STEBI), and the Teacher Activity Survey (TAS). The OHI-S was used to measure school climate, the STEBI was used to measure science teacher efficacy, and the TAS was used to measure professional development, and correlational statistics were used to analyze the data. Results indicated that school climate and science teacher efficacy are the most influential factors on science teacher retention in urban schools. Future research should continue in this vein with science teacher retention in rural schools and suburban schools for comparative purposes. Principals should maintain a positive school climate by including teachers in the decision-making process and providing adequate support. Schools and school systems should focus on creating and implementing policy to sustain retention efforts.

INDEX WORDS: science teachers, retention, urban schools, science teacher efficacy, professional development, school climate, gender differences in science teaching

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DEDICATION

This dissertation is dedicated to my parents, James & Elizabeth Holt. There would be no me without them. From the time I was old enough to remember, they supported my academic dreams and goals. Momma in particular stressed the need for me to have as much education as possible so that I would not be restricted to constrained career choices. She wanted me to have options. This document represents those options and is my ticket out the door.

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CHAPTER ONE: INTRODUCTION

Overview

The following dissertation is about some of the factors that influence the retention of science teachers in urban schools. In recent years, teacher retention has become important in the minds of educators and those who instigate educational policy. Research findings suggest that there is a national teacher shortage (Buckley, Schneider & Shang, 2005; Cochran-Smith, 2004; Ingersoll, 2006, 2009). However, other data indicate that there is not a teacher deficit; rather a declining pool of teachers of specific disciplines, such as science, mathematics and special education (Cullis, 2009; Gullet, 2005; Ingersoll, 2003, 2006, 2010; Rinke, 2007). There are approximately 7.2 million school teachers working in 127,011 school districts across the United States (U.S. Census Bureau, 2011). Almost 500,000 of these are classified as mathematics and science teachers, and for each year, the media reports that some of these districts struggle to find enough science and mathematics teachers (AAAS, 2010) to fill vacant positions. Turnover in these disciplines are on par with turnover in other academic subjects, but the problem is that there is not a surplus of science and mathematics teachers readily available (Hodges & Tippins, 2009, Ingersoll, 2009; NCTAF, 2007).

Extensive recruiting efforts have been made to alleviate the shortages in these areas, but recruitment does not guarantee that newly-hired professionals will remain in the classroom. One of the problems is teacher mobility. Annually, nearly 33% of the teaching force is in transition

between schools and school districts (Ingersoll & Perda, 2009; Waddell, 2010), and with teachers leaving the profession entirely. The teacher attrition rate is one of the highest of all professions (Waddell, 2010). This is even more problematic in some urban school districts, where teachers are leaving their schools at a rate up to 26% every year (Ingersoll & Perda, 2009; NCTAF, 2007; Waddell, 2010).

There is a wealth of research available on the plight of some urban school districts' supposed inability to retain teachers of certain disciplines like science, mathematics and special education (Bradley & Loadman, 2005; Clewell & Villegas, 2001; Cooper & Alvarado, 2008; Darling-Hammond, 2003; Dillon, 2009; Hanushek, Kain, & Rivken, 2004; Ingersoll, 2006; McKinney, Berry, Dickerson, & Campbell-Whatley, 2007; Waddell, 2010). It needs to be made clear that not every urban school or urban school district suffers from high attrition rates. However, forty urban school districts across the United States report science as their highest-need subject area, with 97.5% of the districts citing an immediate demand for science teachers (AAAS, 2010; Urban Teacher Collaborative, 2000). These high attrition rates of urban science teachers pose a significant burden to school districts because most of said teachers leave teaching due to dissatisfaction with the workplace and the career itself (AAAS, 2010; McKinney et al., 2007; Rinke, 2007; Waddell, 2010). Financial implications for school systems are severe, costing school districts thousands of dollars for each teacher who leaves the profession (Ingersoll, 2003; Kelley, 2004; NCTAF, 2007). Ongoing attrition leads to reduced educational quality (Overbay, Patterson, & Grable, 2009).

Richard Ingersoll, a professor at the University of Pennsylvania and a leading expert on teacher retention, regularly examines trends and patterns in teacher supply and demand for the nation's schools. It should be noted that a significant portion of the large-scale research on

teacher attrition and retention appears to occur in ten-year intervals. This is due to census measurements which provide extensive data on a variety of professions, especially teaching. A critic of Ingersoll's, Jennifer Presley, points out that the data he often relies on are nearly 10 years old (AAAS, 2010), and may not reflect current conditions. Recent studies reports that, within the past decade, the five-year attrition rate for teachers remains constant at approximately 50% (Waddell, 2010). The fact remains that the majority of the available data indicate that the retention situation has changed very little since the start of the decade.

Teacher Retention

Teacher retention is thought to occur when teachers will remain in the profession until they reach the age of retirement. Ingersoll (2006) argues that the basis of the retention problem is the number of teachers per year who move from one teaching position to another or leave the profession altogether. The commonly used term given to these individuals is “movers.” Ingersoll points out that the sheer size of the nation's teaching force in conjunction with the annual turnover rate means that 33% of teachers are in some form of job transition every year. This constant job shift, called teacher mobility, is defined as teachers moving between schools and school districts, or teachers leaving the profession altogether. Ingersoll describes this phenomenon as the “revolving door.” Considering that there are approximately 7.2 million teachers in the United States, this translates into 2.4 million movers every year (U. S. Census Bureau, 2010). Sixteen percent of this number (384,000) denotes the proportion of teachers who leave the profession in any given year. The percentage is higher (20% or 617,760) for teachers in urban schools with high concentrations of poor and low-SES students (Bradley & Loadman, 2005; U.S. Census Bureau, 2010; Waddell, 2010).

Some research indicates that beginning teachers are the group most critically affected by attrition (Guarino, Santibanez, & Daley, 2006; NCTAF, 2007; Overbay et al., 2009). They leave because they are overwhelmed by the reality of the profession. Inadequate teacher preparation for the actuality of the job has also been tied to low retention rates (Overbay et al., 2009). Ingersoll (2010) concluded that over 90% of newly hired teachers are replacements for recent departures, and that 46% of new teachers leave the profession by the end of five years (Dillon, 2009; Shakrani, 2008; Waddell, 2010). Teachers are departing the profession well before they reach retirement eligibility, and this is the most substantial contributor to teacher shortages (Overbay, Patterson, & Grable, 2009). Some of this is attributable to life changes, such as moving and having children, but some of it is also due to job dissatisfaction. Teachers who decide to become movers are frustrated with their jobs because of low salaries, student discipline problems, lack of support, and little opportunity to engage in decision-making (Buckley et al., 2005; Cochran-Smith, 2004; Cooper & Alvarado, 2008; Ingersoll, 2010; McKinney et al., 2007; NCTAF, 2007; Shakrani, 2008; Waddell, 2010).

In an attempt to shut the “revolving door,” policymakers and practitioners have directed most of their efforts towards the recruitment of new teachers. Programs such as Teach for America, Troops to Teachers, and other alternative certification routes have been created to increase the number of candidates in the teacher employment pool. A review of alternative preparation research has suggested that the data generated on the success of alternate educational programs are inconclusive because said programs have not been around long enough for these teachers to remain in the profession to the point where they are considered expert or veteran teachers (Allen, 2003). According to Linda Darling-Hammond, “. . .these abbreviated

programs...do not produce a stable, high-quality teaching force for schools with the greatest needs.” (2001, p. 14).

A Need for Science Teachers

There is a rising anxiety about the shortage of qualified science teachers in the United States. There is a projected need of about 240,000 science and mathematics teachers over the next 10 years (Sterling, 2004). The latest nationwide Teacher Shortage List for the 2010-2011 school year lists science as one of the teaching shortage disciplines in 48 states, with Utah and Vermont as the only states not suffering from that particular shortage (Bradley & Loadman, 2007; U.S. Department of Education, 2011; Westerlund, Radcliffe, Smith, Lemke, & West, 2011). Barack Obama, President of the United States, said, “...year after year the gap between the number of teachers we have and the number of teachers we need in these areas [mathematics, science, technology and engineering] is widening. The shortfall is projected to climb past a quarter of a million teachers in the next five years—and that gap is most pronounced in predominately poor and ‘minority’ schools” (Obama, January, 2010). High-profile reports from the National Academy of Sciences (2006), the National Research Council (2002), and the U.S. Department of Education (2002) have linked science and mathematics teacher shortages to the quality of educational performance of schools. Consequently, the inability of schools to effectively staff classrooms with competent science teachers has received extensive attention in the national media, has been clarified as a key educational problem, and has been the objective of frequent transformation and policy initiatives (Ingersoll & Perda, 2009). Science teachers are needed, and schools of education are not producing them fast enough. Nor are there enough science-qualified career changers going into teaching (Ingersoll, 2010).

Urban Schools

Even within a state, the distribution of teacher supply is disproportionate. State requirements for certification and for every teacher to be highly qualified, mandated by No Child Left Behind (2004), make it more difficult to fill vacant slots. Low-income districts, particularly in some urban and rural areas, experience a smaller applicant pool, while wealthier and/or suburban districts receive large numbers of applicants (Howard, 2003; Cullis, 2009). Districts that receive an inadequate number of applicants still have positions to fill and may be forced to hire non-certified teachers, those working on emergency permits, or long-term substitutes. Eighty percent of urban districts hire non-certified personnel, 60% hire teachers with emergency permits and 60% hire long-term substitutes. More than 12% of all new hires in urban areas begin teaching with inadequate training (Cullis, 2009; Klein, 2009; Rinke, 2007). Low income rural areas experience similar difficulties (Cullis, 2009; Eppley, 2009; Hodges & Tippins, 2009).

As stated before, there is an abundance of literature in the area of urban school teacher retention. Data suggest that the retention levels of teachers in urban schools are low (Bradley & Loadman, Darling-Hammond, 2003; Dillon, 2009; Hanushek, Kain, & Rivken, 2004; Ingersoll, 2006) and that there are a variety of factors that contribute to it. Martin Haberman (2005) cited poor working conditions, classroom management issues and workload as some of the reasons why teachers leave urban schools, and this is supported by other investigations (Darling-Hammond, 2003; Dillon, 2009; Hanushek, Kain, & Rivken, 2004; McKinney et al., 2007; Waddell, 2010).

However, this is only one side of the story in regards to urban schools. As stated before, the problems of some urban schools are not the predicament of *all* urban schools. There is research about teachers who are not only enduring the rigors of the urban classroom but also

thriving as is evidenced by their students' achievement (Fraser-Abder, 2010; Freedman and Appleman, 2009; Haberman, 2006; Henninger, 2007; Ladson-Billings, 2000; McKinney et al., 2007; Nieto, 2003; Williams, 2003). Fraser-Abder (2010) found some emergent themes for successful urban science teachers: (a) knowing and caring for the whole child, (b) knowing and loving your subject, (c) effective classroom management, (d) expectation and motivation, and (d) understanding the varying limitations of parental involvement. Freedman and Appleman (2009) noted the existence of cohorts or social networks of teachers and the teachers' belief in their ability to make a difference in their students' lives are solid reasons for the retention of teachers in urban schools. Similarly, Henninger (2007) found that teachers who were committed to the profession, had sustained enthusiasm, believed they were making a difference and were actively seeking to make the system better are the teachers who remain in urban schools. The fact that there are indeed teachers who are able to handle the supposed difficulty of urban teaching calls out for more study. The reasons behind their retention would be beneficial to school systems and teacher education institutions. Such information could be used to help in the preparation, support, and retention of new teachers.

This researcher believes that, while there are many determinants to teacher retention, there are three significant factors that greatly influence science teacher retention in urban schools. The factors are school climate, teacher efficacy and professional development. Research suggests that a healthy school climate; a workplace where science teachers have support, adequate resources, autonomy and participation in the decision-making process, is a climate that fosters retention (Amrein-Beardsley, 2007; Dillon, 2009; McKinney et al., 2007; Shakrani, 2008; Waddell, 2010). Science teachers with a strong sense of self-efficacy believe that they can effectively teach science and increase overall student achievement. This type of

positive reinforcement has been shown in the literature to promote retention (Swackhamer, Koellner, Basile, & Kimbrough, 2009). Finally, science teachers' opportunity to further educate themselves through purposeful professional development can lead to better curriculum design and instructional implementation. This, in turn, can lead to gains in student achievement, overall job satisfaction, and thus, increased retention rates (Jeanpierre, Oberhauser, & Freeman, 2005; Loucks-Horsley et. al, 2009; Meyer, 2005). The objective of this investigation is to determine if there is a statistical relationship between these factors, individually and collectively, and the retention of science teachers in urban schools. If such a relationship is determined to exist, then the research can add to the existing body of work.

Factors that Influence Science Teacher Retention

School Climate

A functional definition of school climate, generated by MacNeil, Prater and Busch (2009), is the soul of a school and the essence that draws teachers and students to love the school and want to be a part of it. School climate is one of the top influences on student achievement. A healthy school climate is one that promotes high academic standards, has appropriate leadership and fosters collegiality. Such an environment has highly motivated teachers, which can translate into increased student performance (MacNeil et. al, 2009).

One aspect of school climate, under the dimension of collegiality, is support. This refers to the assistance a teacher may get from colleagues, administrators, and the principal. Typically, new teachers enter the profession after having invested time and finances into becoming a teacher. So it is counter-productive when they are tossed into the classroom with little preparation in the day-to-day aspects of teaching and inadequate support (Donaldson, 2009;

Hughes, 2012; Kelley, 2004; Moore, 2012; Shakrani, 2008). There is much research sustaining the contention that new teachers need assistance. Induction programs have been developed to help new teachers improve their skills and practices, learn professional responsibilities, and ultimately affect positive student learning (Kelley, 2004; Shakrani, 2008; Wong, 2004). Many states have adopted induction programs designed to retain teachers new to the profession.

Another aspect of school climate is administrative support.. Administrative support is significant in teacher preservation. Studies that show the principal's involvement in teacher induction is significant in retaining new teachers (Amrein-Beardsley, 2007; Dillon, 2009; McKinney et al., 2007; Shakrani, 2008; Waddell, 2010).

Science Teacher Efficacy

Studies have shown that new teachers enter teaching primarily for its inherent or psychological rewards—that is, the opportunity to engage in meaningful work, the pleasure of working with children, and love of a particular subject area—rather than extrinsic rewards such as salary or public respect (Espinet, Simmons, & Atwater, 1992; Goodlad, 1984; Hughes, 2012; Lortie, 1975). The Status of the American Teacher Survey conducted by the National Education Association determined that 73% of its respondents indicated that the “desire to work with young people” was one of the most important reasons for entering the profession and 68% indicated that it was the reason they remained. The intrinsic reward gained for making a difference in a student's life is a great draw to the field (Hughes, 2012; Lortie, 1975). The belief that one has the ability to be effective in instructing students is an innate value called self-efficacy. In other words, self-efficacy is a teacher's sense of competence. Therefore, science teacher efficacy, by extension, is a teacher's competence in teaching science effectively.

Self-efficacy is a fluctuating characteristic and can change as one gains experience, and is also situation-specific. A teacher may feel efficacious in some content areas where they are comfortable based on prior experience and education and yet feel ineffective in other areas. Out of field teachers report a low sense of efficacy (Johnson, 2005). Teacher efficacy is also affected by the students with whom one is working. A teacher may find that one group of students respond better to their teaching style than another group and may feel more satisfaction with greater student success.

Professional Development

Susan Loucks-Horsley, Peter Hewson, Nancy Love, and Katherine Stiles (1998) defined professional development as the opportunity offered to teachers to develop new knowledge, skills, approaches and dispositions to improve their effectiveness in their classrooms. Teachers use the knowledge and skills gained from professional development to become better teachers (Meyer, 2005). However, professional development as currently viewed by teachers is one-day workshops where specific objectives are used to develop what teachers should learn during the session (Meyer, 2005). The underlying assumption for this method is that there are certain behaviors or ideas that are considered valuable to classroom practice and teachers can modify their behavior to model this approach (Loucks-Horsley et. al, 2009; Meyer, 2005). This kind of professional development is cost-effective to school districts and schools because the information provided is generalized across disciplines (Loucks-Horsley et. al, 2009; Meyer, 2005). This is ineffective for most teachers because application of the generic content can be difficult for specific disciplines such as science (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009).

Science teachers agree that it is important to provide teachers with experience that they can model in their classrooms. Effective professional development must make these experiences available if increases in student learning and achievement are the overall goal for a school (Jeanpierre, Oberhauser, & Freeman, 2005). For science teachers, professional development should be content-specific, structured and ongoing (Darling-Hammond et. al, 2009). Such characteristics can lead to greater consistency in instruction and afford teachers the opportunity to take risks and share practices. These elements contribute to overall job satisfaction and thus, retention (Loucks-Horsley et. al, 2009; Meyer, 2005).

Definition of Terms

It is necessary to define the salient terms that will be used in this dissertation: attrition, inductee, induction, mentoring, migration, novice, professional development, retention, school climate, secondary teachers, self-efficacy, and urban school.

Attrition

Attrition is a component of teacher turnover that specifically focuses on the rate of teachers who leave the profession within a given amount of time (Boe, Cook & Sunderland, 2008).

Inductee

An inductee is a teacher with zero to three years' full-time teaching experience. This term is used interchangeably with "novice" (Berliner, 1988; Feiman-Nemser, 2003; Patterson & Luft, 2004).

Induction

Induction is a developmental process that establishes the teacher as a professional. It refers to a variety of different types of activities for new teachers—orientation sessions, faculty collaborative periods, meetings with supervisors, developmental workshops, extra classroom assistance, reduced workloads, and mentoring (Ingersoll & Strong, 2011).

Mentoring

Mentoring is the personal guidance provided to new teachers, usually by veterans. In recent decades, teacher mentoring programs have become a dominant form of teacher induction (Britton, Paine, Raizen, & Pimm, 2003; Hobson, Ashby, Malderez, & Tomlinson, 2009; Strong, 2009).

Migration

Migration is a component of teacher turnover that refers to teachers moving from school to school or district to district (Boe, Cook & Sunderland, 2008).

Novice

A novice is a teacher with zero to three years' experience. This term is used interchangeably with "inductee" (Berliner, 1988; Feiman-Nemser, 2003; Patterson & Luft, 2004).

Professional Development

Professional development is a variety of opportunities provided to teachers to further existing knowledge and develop new skills and abilities designed to improve their effectiveness and increase student achievement (Loucks-Horsley, Hewson, Love & Stiles, 1998).

Retention

Retention is the phenomenon whereby a teacher remains in the same school for a considerable portion of their career (Ingersoll, 2003).

School Climate

School climate refers to the quality and character of school life. The school climate is influenced by the physical environment of the school, the characteristics and mix of students, teachers and parents who are members of the school community, the connections between the school and its surrounding neighborhood, the social interactions within the school, the leadership role played by the school principal, the morale of the teaching staff and their teaching practices in classrooms, the formal policies on student discipline, staff conduct and parent/volunteer roles adopted, implemented and enforced by schools (National School Climate Center, 2012).

School climate differs from school environment in that the school environment refers to the physical building, the fairness and adequacy of disciplinary procedures, the academic environment, and student health, including the available physical and mental health supports and services, as supported by relevant research and an assessment of validity (Federal Register, 2012). For the purposes of this paper, school environment is considered a component of school climate.

Secondary teachers

These are teachers at the middle school and high school level; grades six through 12.

Self-Efficacy

Self-efficacy refers to a person's beliefs about their capability to successfully carry out a particular course of action and produce desired levels of performance (Bandura, 1997; Klassen & Chiu, 2010). These beliefs determine how people feel, think, behave and motivate themselves.

A teacher's self-efficacy influences her/his teaching behaviors and their students' motivation and achievement. Science teacher efficacy refers to teachers' confidence in their abilities to teach science effectively (Bleicher, 2004).

Urban School

An urban school has (a) larger enrollments than their suburban or rural counterparts; (b) a high concentration of low income students on free and reduced lunch; (c) lower achievement scores than suburban schools; (d) student behavior problems which include pregnancy, absenteeism, weapons possession, and classroom disciplinary issues; and (e) teachers that have access to fewer resources and less control over their curriculum, and has more teachers on provisional certificates or are teaching out-of-field (Center for Technology Education at Johns Hopkins, 2006).

Research Questions

Since teacher retention in urban schools is problematic, this researcher has chosen to pursue a correlational investigation regarding the retention of science teachers in urban schools. According to the literature, school climate, science teacher efficacy and professional development are considered to be significant factors that influence urban science teacher retention. As a result, the following are the research questions that will be used to guide the study:

1. Is there a statistical relationship between school climate and the retention of science teachers in urban schools?
2. Is there a statistical relationship between teacher efficacy and science teacher retention in urban schools?

3. Is there a statistical relationship between professional development and science teacher retention in urban schools?
4. What are the best predictors among school climate, teacher efficacy, and professional development to science teacher retention in urban schools?
5. Are there gender differences in the perceptions of science teachers in regards to school climate, science teacher efficacy and professional development?

Context of the Study

This investigation focuses on teacher retention in urban schools. There are multiple perspectives when reviewing literature and data for urban schools. One of them is the deficit model, which is based on the assumption that a school's lack of educational success is attributed to problems rooted within its surrounding community and the culture of the students who populate it. While aspects like resource availability, teacher control, and staff experience are key components of the deficit model research, this dissertation does not rely solely on this model as its foundation because the researcher does not assume that the science teacher attrition rates in urban schools are the result of community problems, and not all of the urban schools in this study are deemed "deficient" by that standard.

Rationale

This investigation addresses the critical need for a stable, qualified, and consistent teaching force in urban science education. Science is frequently cited as a critical need in many school districts. As Ingersoll (2009) points out, although science teacher turnover levels approaches that of other subjects, science does not have a surplus of new teachers available to

replace those who have left. This lack of availability complicates the issues surrounding recruitment and retention. Due to federal mandates of a highly-qualified teacher in every classroom (U.S. Department of Education, 2004), many school districts have expanded their recruitment and retention efforts. However, continued attrition negates these retention efforts, and school systems need to figure out a way to reduce teacher outflow.

The following study aims to build upon existing research by combining what is known about urban science teacher retention with three influential factors. The expectation is that a statistical relationship exists between a science teacher's years of experience and school climate, science teacher efficacy, and professional development. The researcher seeks to expand on this idea by determining the best predictor of these factors that will lead to a science teacher being retained in an urban science classroom. If a statistical relationship can be determined to exist between these phenomena, then this investigation will add to the existing literature on teacher retention, urban schools, and science teaching. To date, there have not been any studies statistically relating a science teacher's years of experience with school climate, teacher efficacy and professional development. Understanding the nature of the relationship between science teacher retention and the climate of the school in which the teacher works, how the teacher feels about their ability to teach science successfully, and whether they are receiving adequate professional development designed to increase student achievement can provide insight to those who work with and employ science teachers. The expected findings will generate practical implications for teacher education programs and for those urban school districts that employ and wish to employ qualified science teachers.

Summary

This dissertation focuses on determining if a statistical relationship exists between a science teacher's years of experience and school climate, science teacher efficacy, and professional development. An overview described some of the research addressing the problem of teacher retention and how it relates to science teaching and urban schools. Teacher retention as a phenomenon was discussed, as was the plight of urban school districts' difficulty in retaining teachers in critical-need areas such as science and mathematics. The issues regarding the discipline of science and the necessity of finding qualified science teachers for every school is also addressed. The factors to be investigated are described, and a glossary of salient terms is provided. The chapter closes with a statement of the problem, five research questions, a context, and a rationale for the study. The next chapter will detail the relevant research on factors that influence teacher retention in order to set the framework for this particular study.

CHAPTER TWO: LITERATURE REVIEW

Overview

The first section of Chapter Two will discuss the professional life cycle of a teacher. The chapter will then go on to review the literature associated with attrition, science teaching, and teacher retention in urban schools, as well as the influential factors denoted in Chapter One: school climate, teacher efficacy, and professional development. Each of these factors will be deconstructed and linked to the current literature on science education reform. Also, this chapter will discuss the relevant research connected with teacher retention in science and in urban schools, and attempt to tie these concepts together. The chapter will end with a summary of its contents.

Teacher Classification

David Berliner (1988) described the development of expertise in pedagogy as consisting of five stages of skill development in teachers. The stages are very specific for teachers who have less than five years of experience. *Novices* are teachers who are beginning first year teachers. *Advanced beginners* are often in the second and third years of their teaching experience, and “if they have any talent or motivation whatsoever, about the third or fourth year they may become *competent*” (p. 2). Around the fifth year, these teachers move into the realm of *proficient*, and some of these proficient teachers will reach the highest stage, that of *expert*.

Sharon Feiman-Nemser (2003) introduced the idea of a professional learning continuum for teachers. The continuum differs from Berliner's classification in that it includes preservice preparation and does not provide detailed specifics in regards to actual years of experience. A preservice teacher's needs include learning how to examine their prior beliefs about teaching, developing content knowledge, understanding the nature of learning and developing a novice repertoire. The time from when a teacher is hired through three years of employment is considered inductee years. Professional development needs after the induction period include extending and expanding subject matter knowledge as well as repertoires of curriculum, instruction and assessment, and increasing responsibilities and leadership skills. In both examples of a teacher's professional life cycle, the idea generated is one of a linear progression from novice to master and from developing to expanding. Sato, Roehrig, and Donna (2010) put Feiman-Nemser's continuum in a visual format. See Figure 2.1.

Figure 2.1 Teacher Professional Learning Continuum



Researchers identify a teacher who is in their first three years in the classroom as a *novice* or *inductee* (Feiman-Nemser, 2003; Roehrig & Luft, 2006; Sato, Roehrig, & Donna, 2010). Additional research shows that 30% to 50% of these neophytes leave the teaching vocation

during this time (Bradley & Loadman, 2005; Carr, 2009; Dillon, 2009; Greiner & Smith, 2008; Kearney, 2008; Quartz, 2003). The reasons these new teachers vacate the profession typically fall under job dissatisfaction. There is no specific instrument that measures teacher job satisfaction, but according to the literature, the most common reasons include low salaries, lack of administrative support, student discipline problems, lack of student motivation, and lack of influence over school decision-making (Bradley & Loadman, 2005; Buckley et al, 2005; Certo & Fox, 2002; Ingersoll, 2003, 2006, 2010; Quartz, 2003; Sato, Roehrig, & Donna, 2010).

This phenomenon relates to the quality of student learning, which makes teacher retention even more important. If a brand-new teacher does not stay in the profession long enough to achieve some degree of competence, then students are constantly being taught by individuals in the early stages of career development. The logical outcome of this phenomenon is that, over time, the achievement and comprehension of students taught by these early career teachers will decrease (Berliner, 1988; Sato, Roehrig, & Donna, 2010). Research suggests that the most underserved children (those in low-income urban and rural areas) have little chance of being taught by teachers with more than five years' experience, and without the benefit of an experienced teacher, secondary school students will continue to be inadequately prepared (Bradley & Loadman, 2005; Dillon, 2009; Donaldson, 2009; Quartz, 2003; Wynn, Carboni & Patall, 2007), which is a logical result of high teacher turnover in school systems.

Teacher Attrition

There are two types of teacher turnover. Attrition refers to those who leave the occupation of teaching, and migration refers to those who transfer or move to different teaching jobs in other schools (Ingersoll & Perda, 2010). Research typically emphasizes attrition and

neglects migration because many assume that migration does not affect overall teacher supply (Boe, Cook, & Sunderland, 2008; Ingersoll & Perda, 2009; 2010). This is correct from a systemic level of analysis, but from the perspective of those who manage schools and school districts, migration and attrition have the same effects: a decrease in staff that must be replaced (Cullis, 2009; Kelley, 2004; Wynn, Carboni, and Patall, 2007). District investments include recruiting expenses, administrator time commitments, and costs associated with professional development, mentoring and orientation programs for new staff members. From an organizational viewpoint, high levels of attrition disrupt school programs and goals for students (Ingersoll, 2004; Kelley 2004). From an instructional perspective, school districts should appreciate the intrinsic value of retaining teachers who make large gains in teaching effectiveness in their early years (Kelley, 2004).

From the school's standpoint, teacher migration can contribute to the problem of keeping schools adequately staffed with qualified teachers (Boe, Cook, & Sunderland, 2008; Ingersoll & Perda, 2009; Waddell, 2010). High attrition rates jeopardize the stability of educational programs. If a school experiences high teacher turnover for several successive years, it is difficult to institute professional learning communities or a consistent specialized professional development program. Teacher learning effectiveness increases during the first four years in the classroom, so if new hires continue to vacate the position during this critical time, schools will not benefit from this learning (Darling-Hammond, 2006; Klein, 2009).

Urban Schools

All school districts suffer from some form of teacher attrition, as it is healthy for the continuance of any successful school system. However, some urban school districts—typically

those with higher populations of underserved students and/or populations with high numbers of students with low socioeconomic status—suffer from attrition at a rate of 2.5 times as much as suburban school districts (Bradley & Loadman, 2005; Dillon, 2009; Fraser-Abder, 2010; Ingersoll & Perda, 2010; McKinney, Berry, Dickerson, & Campbell-Whatley, 2007; Quartz, 2003; Waddell, 2010). The high attrition rate in low-income urban schools is a persistent problem. These schools are traditionally difficult to staff (Darling-Hammond, 2003; McKinney, Berry, Dickerson, & Campbell-Whatley, 2007; Quartz, 2003; Waddell, 2010), replacing up to one-fifth of their entire faculty each year (Ingersoll, 2006; Ingersoll & Perda, 2010). Last-minute high turnover, which is common in many urban schools, makes it difficult for administrators to plan the school year (Darling-Hammond, 2003; McKinney, Berry, Dickerson, & Campbell-Whatley, 2007).

A large number of urban schools typically serve a multiethnic population subject to social, economic and political discrepancies (Ladson-Billings, 2001; Robertson & Ward, 2006; Quartz, 2003; Sachs, 2004; Yendol-Hoppey, Jacobs, and Dana, 2009). They have a higher percentage of teachers with little experience. These schools also suffer from low student achievement, inadequate school readiness, low parental involvement, lack of discipline, language barriers and poor student health (Robertson & Ward, 2006; Sachs, 2004; Yendol-Hoppey, Jacobs, and Dana, 2009). These problems have a major impact on student learning and teacher retention.

Teachers seeking employment in urban settings often face conditions that set them up to fail, such as overcrowded schools, large class sizes, a lack of resources, and a high number of novice teachers paired with a overwhelmed veteran staff (Fraser-Abder, 2010; Klein, 2009; Yendol-Hoppey, Jacobs and Dana, 2009). As a result, there has been an increase in teacher

migration and attrition out of these school settings and the profession altogether (Klein, 2009; Marvel, Lyter, Peltola, Strizek, Morton, & Rowland, 2007). The vacated positions frequently get filled with teachers that are not fully certified. The placement of a lower quality teaching staff comprised of individuals with less content understanding or less pedagogical content knowledge into classrooms have been linked to lower student achievement (Freedman & Appleman, 2009; Klein, 2009).

Science

Science is a content area that is experiencing higher than average teacher attrition rates. Almost 40% of science teachers leave the profession because of poor salary and lack of administrative support (Fraser-Abder, 2010; NSTA, 2012). Each year, 32% of science teachers with less than three years' experience consider abandoning the profession (Dillon, 2009; Ingersoll, 2010; Shakrani, 2008; Waddell, 2010). Urban school districts report science as their highest-need subject area. High attrition rates for science teachers in urban school pose a significant burden to school districts. Ingersoll and Perda (2009) discovered that there is little significant difference in why science teachers leave the profession as compared to teachers of other subjects. Some of the personal reasons listed for leaving include family, health, and relocation opportunities. However, the main reason why science teachers vacate the profession before retirement falls under job dissatisfaction (Buckley et al., 2005; Cochran-Smith, 2004; Cooper & Alvarado, 2008; Ingersoll, 2010; McKinney et al., 2007; Shakrani, 2008; Waddell, 2010). Specific reasons include low salary and benefits, large class sizes, inadequate preparation time, lack of input in decision-making and out-of-field teaching assignments (Buckley, Schneider, & Shang, 2005; Ingersoll, 2003; Kersaint, Lewis, Potter, & Meisels, 2007).

The phenomenon of out-of-field teaching is the result of teachers being assigned subjects for which they are not properly prepared. This is a serious issue in the discipline of science. Principals have positions to fill and typically have trouble finding a certified teacher or are unable to afford to do so, which has led to the increase of out-of-field teaching, especially in urban schools (Dillon, 2009; Ingersoll, 2006; NSTA, 2012). Just because one holds a specific certification does not mean that they are teaching in their area of expertise. For example, a high school teacher may possess a degree in biology and hold a 6-12 science certification, yet be asked to teach physics or chemistry. Biology content is different from chemistry or physics content. Ingersoll (2003) showed that a large number of science teachers were assigned positions in which they did not have a major or minor in that subject area. Teachers were routinely asked to teach outside of their area of expertise and trained disciplines (Ingersoll, 2003; Cullis, 2009). As a result, more than half of the secondary students enrolled in physical sciences were instructed by teachers who did not have subject-specific knowledge (Ingersoll, 2003; Cullis, 2009). According to the most recent Schools and Staffing Survey, 20% of all science teachers who completed the survey reported that they were teaching out of field (Cullis, 2009). This has remained consistent with the National Science Teachers Association's (2000) survey findings at the start of the century. There is no current data beyond 2008 available to contradict these findings.

No Child Left Behind (2004) sought to reduce the number of teachers teaching out-of-field, but the process to do so has been slow and inconsistent. While percentages of said teachers have dropped, the difference is only by one to two percent, especially in science and mathematics (Kolarik, 2010). The reasons for this are unclear, as each state that participated in the legislation to implement NCLB policy did so in different ways. Some states may have

introduced certification requirements at NCLB's inception and others may have implemented stricter regulations in order to be in compliance (Kolarik, 2010). Regardless, the percentages of teachers teaching out-of-field is still much higher than the law stipulates it should be (Kolarik, 2010).

Factors that Influence Science Teacher Retention

School Climate

The achievement rates of students are directly dependent on the effectiveness of their teachers. A teacher labor force that is well-educated, engaged in continuing professional development, and committed to staying in the school will result in all students receiving appropriate instruction and increasing their performance (Lynch, 2010). A point of significance in student accomplishment is the conditions under which teachers work (Hirsch, Emerick, Church, & Fuller, 2006; Hughes, 2012; Lynch, 2010; Moore, 2012). These conditions are components of what is hereby referred to as school climate. Researchers as well as the National School Climate Center have acknowledged that while there is no concrete definition of school climate, there is some consensus on its components (2012). In Chapter One, school climate was essentially defined as the "soul" of a school. The word "soul" refers to a school's quality and character, and it is influenced by the physical structure, the student body, the faculty and staff, the administration, and the surrounding community (National School Climate Center, 2012). The definition of school climate provided in Chapter One is the relevant meaning for this paper.

Susan Wynn, Lisa Carboni, and Erica Patall (2007) believe that a healthy school climate is one that reflects the supportive working conditions, with both human and physical factors, necessary for a professional learning community. A learning community is a group of teachers who have shared interests and collaborate in an atmosphere in which cognitive and affective

aspects are required for community development (Wynn et al., 2007). A positive, interactive environment has been created and teachers in these environments report feeling more effective, more able to meet student needs and more positive about their profession. There are five dimensions that help to characterize a school as a learning community: encouraging and shared leadership, shared values and vision, collective learning and application of learning, supportive conditions and collective personal practice. These dimensions mesh with ideas on retention research that suggest induction, school climate and principal leadership impact beginning teacher retention (Boyd et al., 2009; Hughes, 2012; Ingersoll & Strong, 2011; MacNeil, Prater, & Busch, 2009; Mishra & Acharya, 2011; Moore, 2012; Wynn et al., 2007).

In their study on school culture and school climate, MacNeil, Prater, and Busch (2009) viewed climate from a psychological perspective and defined it in terms of behavior. Climate is a measurable construct when it comes to the organizational health of a school. MacNeil et al. (2009) describe climate as the heart and soul of a school; the essence which makes students and teachers want to be a part of that school. This is important because school climate has a major influence on student achievement (MacNeil et al. 2009). Principals who focus on specific aspects of school climate that positively affect student achievement tend to have healthier schools (Boyd et al., 2009; MacNeil et al. 2009).

MacNeil, Prater and Busch (2009) imply that a healthy school climate is one that promotes high academic standards, has appropriate leadership and reinforces collegiality. Such an environment has better motivated teachers, which can translate into increased student performance and teacher retention. The climate factors that are most relevant in the current study are teacher support and school environment. Teacher support encompasses induction and

administrative assistance, while the school environment looks at the actual facility, working conditions, equipment and supplies that teachers need to be effective (MacNeil et al. 2009).

These perspectives have the same overall components. A healthy school climate is one that has an effective induction program, supports a collaborative learning environment where novice teachers have mentors and reflective time, instructional teamwork with members of their respective departments, and administrative support (Boyd et al., 2009; MacNeil et. al, 2009; Wynn et. al, 2007). A collaborative learning environment is one where there are open lines of communication and support between teachers, mentors, department chairs and principals. Instructional collaboration is when teachers interact with other teachers within their department in regards to lesson planning, school rules, classroom management and behavior plans, materials and course assignments (MacNeil et. al, 2009; Wynn et. al, 2007). Administrative support is when a principal promotes a democratic environment for teachers. Such an environment has operational leadership, fosters feedback, encourages teachers to participate in meaningful decision-making and provides strong instructional support (Boyd et al., 2009; Johnson & Birkeland, 2003; MacNeil et. al, 2009; Wynn et. al, 2007). Instructional support begins with induction.

Induction.

Belonging, a basic human need, translates into retaining skilled teachers when continuous, structured and thorough education programs are in place to prepare novices and replenish veterans for the rigor of the classroom. Because estimates of teacher attrition are as high as 40-50% of inductees leaving the field within the first five years (Dillon, 2009; Feiman-Nemser, 2003; Fraser-Abder, 2010), there needs to be appropriate support systems in place to combat this problem. Induction programs provide important associations between novices and

the veteran staff. This is because they are situated around a learning community where all teachers are treated with respect and their contributions are valued.

There is a wealth of research on induction programs for new teachers (Ingersoll & Strong, 2010; Luft, Roehrig, & Patterson, 2002; Luft, Firestone, Wong, Ortega, Adams, & Bang, 2011; Stanulis & Floden, 2009; Roehrig & Luft, 2006; Smith & Ingersoll, 2004; Wang, Odell & Schwille, 2008). The consensus is that teachers who are new to the profession need support. Transition into the occupation can be eased through comprehensive induction programs that are designed for new teachers to increase their confidence and effectiveness in order to curtail high levels of attrition (Heller, 2004; Ingersoll & Kralik, 2004; Wynn, Carboni, & Patall, 2007). This is supported by research that indicates that support and mentoring programs for new teachers have a positive impact on their retention (Ingersoll & Kralik, 2004; Ingersoll & Strong, 2010; Luft, Roehrig, & Patterson, 2002; Luft, Firestone, Wong, Ortega, Adams, & Bang, 2011; Roehrig & Luft, 2006). Those responsible for school leadership and policy often do not realize that creating quality induction programs can make a significant difference in teacher contentment and retention (Stanulis & Floden, 2009). There have been efforts made at the state level to enforce the utilization of induction in school districts. Twenty-six states have mandated induction programs, and 80% have participated in some kind of formal induction program (Lynch, 2010; Roehrig & Luft, 2006). However, there are no details about the kind of induction program these states are mandating, and the majority of these programs are underfunded (Roehrig & Luft, 2006), and to date, the effectiveness of these programs remains a mystery.

Linda Kelley (2004) suggested that while existing induction programs vary in their substance and quality, most programs provide superficial types of assistance such as district orientations, periodic workshops, or instructions in general classroom management strategies.

Some schools and school districts present induction as an evaluation process that applies mechanical criteria for rigidly-defined teaching behaviors to assess novices' performance. Roehrig and Luft (2006) describe the majority of induction programs as district-run and generic; designed to meet the needs of all teachers regardless of their grade level, subject assignment, or experience. More often than not, a school's idea of an induction program is the assignment of a veteran teacher as mentor to a novice teacher. This is not always beneficial because not all teachers make good mentors. It also becomes an issue of volunteerism and availability (Ingersoll & Strong, 2010; Stanulis & Floden, 2009). This kind of neglect can cause premature burnout as new recruits experience disenchantment and an inability to cope with the daily pressures of teaching. Short-term and shallow induction programs are inadequate and can foster attrition, as basic needs are not being properly served (Darling Hammond et al., 2009; Roehrig & Luft, 2006).

A comprehensive induction program is one of the best things a school district can provide to increase retention rates of new teachers. Recent findings indicate that such programs can reduce turnover by 50% and decrease the time it takes for teachers to achieve proficiency (Johnson & Birkeland, 2003; Stanulis & Floden, 2009; Wynn et al., 2007). The programs should include mentoring, education, networking and formal assessments for at least the first two or three years of a teacher's career (Dillon, 2009; Kelley, 2004). A teacher induction program can help new teachers improve practices and learn professional responsibilities that can affect student achievement. They can also become part of collaborative learning environments with veteran teachers. These benefits can lead to increased retention rates (Kelley, 2004; Ingersoll & Strong, 2010; Malow-Iroff, O'Conner, & Bisland, 2007; Shakrani, 2008; Stanulis & Floden, 2009).

Richard Ingersoll and Michael Strong (2010) did a comprehensive review of induction programs at state and national levels. They examined research from the past decade to determine the impact induction programs have on teacher retention. Some of the conclusions they were able to draw from the various studies showed that content duration and delivery of induction programs vary so much from school to school and district to district that it is difficult to generalize research findings. Policymakers and administrators should design induction programs that have a strong focus on the selection and training of mentors to ensure high levels of support (Ingersoll & Strong, 2010). Participation in induction by itself had little effect on teacher retention, classroom practices and student achievement. Inclusive programs comprised of components such as mentoring, collaboration and planning time had the most effect on a teacher's commitment to remain in the same school. These effects held up in both high poverty and high "minority" enrollment schools, and also held up across school levels (Ingersoll & Strong, 2010). Novice teachers, as well as teachers who were teaching out-of-field, also benefitted from all-inclusive induction programs and had higher retention rates (Ingersoll & Strong, 2010; Kelley, 2004). Teachers participating in diverse induction programs are significantly associated with retention, but it is dependent on the type of support received. The strongest indicators of positive retention rates are the inclusion of a mentor and collaboration time with other teachers (Ingersoll & Strong, 2010).

In a breakdown of the most recent Schools and Staffing Survey statistics and the follow-up data, Ingersoll and Strong (2010) found that the amount and quality of induction received varied by school poverty level. Teachers in high poverty schools were as likely, if not more so, to receive and participate in induction programs. Comprehensive induction procedures were associated with higher retention rates in low poverty schools. In terms of student achievement,

novice participants in inclusive induction programs had, on average, equal or greater gains than those of more experienced teachers (Ingersoll & Strong, 2010). These findings are encouraging.

A key component of induction is mentoring. Mentoring and induction are not synonymous; induction is a socialization process and mentoring is an action within the induction process. Ingersoll and Strong (2010) define mentoring as the personal guidance provided by seasoned veterans to inductee teachers in schools. A mentor's basic function is to contribute to a new teacher's assimilation. To be of significant use to an inductee, a mentor must be used in conjunction with other components of an induction program (Roehrig & Luft, 2006; Ingersoll & Strong, 2010; Stanulis & Floden, 2009; Wang, Odell, & Schwille, 2008). To be effective, a mentor should be well-informed of the mission and goals of the school and the school district. Even more effective is for a veteran teacher to be a part of a district-wide comprehensive mentoring program. According to both Ingersoll and Strong (2010) and Roehrig and Luft (2006), the problem with many schools is that mentors are not part of a program; the mentor is simply a veteran teacher assigned to a novice. This process has increased attrition among new teachers because they consider it inadequate support and become discouraged. Currently, in over 60% of the United States' school districts, this standard of mentoring is practiced and little else is provided to help new teachers (Hirsch, Emerick, Church, and Fuller, 2006; Ingersoll & Strong, 2010; Kelley, 2004; Roehrig & Luft, 2006).

Some countries have developed complex induction programs with strong mentoring components. Britton, Paine, Pimm, and Raizen (2003) reported on the programs in Switzerland, Japan, France, China and New Zealand. They found that although each country's approach is different, their induction programs have three common characteristics. They (a) are comprehensive, (b) have a sustained professional development program, and (c) encourage

meaningful collaboration. In the United States, however, isolation is the common thread and complaint among new teachers. As of now, it is common practice to give novices the most difficult assignments with inadequate equipment, supplies and facilities (Cullis, 2009; Ingersoll, 2004). If there are no structured induction programs in place, new teachers suffer from isolation, which reduces job satisfaction at the most crucial point in their career, and increases the risk for leaving (Darling-Hammond, 2001; Hirsch, Emerick, Church and Fuller, 2006; Kelley, 2004). Such prepared programs provide time for expert teachers to guide or coach novice teachers and research has shown that this type of mentoring reduces attrition rates by more than two-thirds (Darling-Hammond, 2001; Hirsch, Emerick, Church, and Fuller, 2006; Ingersoll & Strong, 2010; Kelley, 2004; Roehrig & Luft, 2006). New teachers gain confidence with the continued support and veteran teachers have the opportunity to take on new leadership roles.

School Administration.

A school with a positive climate has teachers with high morale and open lines of communication. It implies positive team building and faculty engagement. Effective communication requires a level of trust, mutual respect, and clarity of function. Teachers in such climates obtain a considerable amount of job satisfaction and they have an incentive to keep the organization moving. Teachers are more likely to remain in the profession when they are satisfied with their leadership and the climate. Healthy schools serve to stimulate best efforts by providing meaningful work, motivating challenges, and continuous opportunities for learning. Data from previous research shows that school health is positively related to faculty trust and trust in the principal (Boyd et al., 2009; Mishra, & Acharya, 2011).

Research shows that at least 33% of the turnover in a school or school district is due to dissatisfaction in the workplace and/or lack of support (Dillon, 2009; Ingersoll 2006; Lynch,

2010). Teachers who receive support from their principals experience less stress and burnout than those who do not (Dillon, 2009; Ingersoll 2006; Lynch, 2010). The principal is the driving force behind the operation of a school. The type of leadership the principal exhibits sets the stage for how teachers, students and parents will interact and how the school will function. The principal defines the school climate and working conditions in which the teachers operate. Principals influence teachers' work experiences in numerous ways through communication, job design and autonomy, the provision of learning opportunities and resources, and the nature and extent of feedback given to teachers. Principals also influence the collegial environment in their schools by fostering shared goals, values and professional growth (Boyd et al., 2009; Dillon, 2009; Hirsch, Emerick, Church, and Fuller, 2006; Ingersoll 2006; Lynch, 2010). Findings show that administrative support plays a large part in shaping teachers' attitudes towards teaching, commitment and satisfaction (Boyd et al., 2009; Cullis, 2009; Ingersoll, 2000; Johnson et al., 2005; Lynch, 2010; Wynn et al., 2007).

Many studies have investigated what leadership traits create a positive working environment for teachers, which leads to increased student learning. Certo and Fox (2002) conducted a study that examined factors that lead to quality teacher retention. Their findings showed that principals who delegated authority, supported collective decision making and instructional collaboration, and shared responsibility for student learning were desirable traits that increased a teacher's sense of professionalism and levels of job satisfaction. It was also noted that a principal's commitment to these goals was evidenced by securing necessary supplies and resources, scheduling collaborative time, praise, equitability in teacher allotments and insulation from distracting outside influences (Certo & Fox, 2002). Lynch (2010), in a similar study, reached the same conclusions.

Principals who are dedicated to maintaining a healthy school environment have a deep understanding of the teachers they lead. They work with the conviction that all teachers have the ability to become effective teachers and positively influence student achievement. They are role models and inspire passion for learning in their faculty (Wong, 2004). Principals who seek to retain new teachers would not usurp their role as a leader by pairing a novice with a veteran and leaving them to sink or swim. A strong principal and administrative team will have the knowledge and skills to direct an induction process that creates and supports a results-based, team-focused professional learning community that is a part of every teacher's workday (Wong, 2004; Wynn, Carboni, & Patall, 2007).

In their investigation, Wynn, Carboni, and Patall (2007) revealed that principals who retain teachers are successful entrepreneurs who believe that strong instructional, operational and strategic leadership have equal importance. Feedback, direct assistance, collaborative working conditions and involvement in meaningful decision making were perceived as important by principals who worked in schools characterized by high retention rates (Hirsch, Emerick, Church, and Fuller; 2006; Leithwood, Lewis, Anderson, & Wahlstrom, 2004). Similar administrative practices were identified by Blasé and Blasé (2004). Their findings reported that effective principals praised teachers, extended autonomy and participated in shared decision-making.

Boyd, Grossman, Ing, Lankford, and Wyckoff (2009) completed a study regarding the influence of administration on teacher retention. They examined six contextual factors: teacher influence, administration, staff relations, students, facilities, and safety. Their data come from surveys of first-year teachers, and then their retention a year later. Then the data were generalized across all the teachers in that district that did not complete the survey. Results

showed that well over 40% of the participating teachers cited dissatisfaction with administration as a reason for leaving or considering leaving. Less than 10% found their principals to be exceptional in communicating respect or appreciation for their teachers, and 20% of the participating teachers who left the school never worked with the staff. Thirty percent said that their principal did not encourage professional collaboration. Administration emerged as the main factor for low retention.

Boyd et al. (2009) offer a potential explanation using labor market dynamics. Principals have preferences for high-performing and low-poverty schools. When an opportunity comes to obtain such a position, some administrators move towards these jobs, leaving a leadership vacancy in schools on the opposite end of the spectrum (low-performing and high-poverty). The role of the principal is going to be more difficult in these schools, which may also have low retention rates and greater accountability pressures. Schools with high proportions of low-income and low-performing students tend to have administrators who are in less demand, such as untested principals (Boyd et al., 2009).

The results of Boyd et al.'s (2009) investigation have some limitations. While evidence is provided about the significance of appropriate school leadership and its effects on retention, the data do not provide enough detail or richness about the role of administration to determine how or why administrative support affects teachers. Teachers have different perspectives in regards to what supportive administration is, and the instrumentation used to collect this data does not account for it (Boyd et al., 2009).

These investigations support the contention that administrative support and a strong school leader positively influences teacher commitment and retention. Boyd et al.'s (2009) research further indicates that when principals communicate clear expectations, provide

assistance and support teachers, then teachers experience greater professional commitment and retention increases. Conversely, a lack of principal influence and support can create an atmosphere of helplessness and frustration, which leads to teacher attrition. Strong school management is essential to retaining teachers. Effective leadership that provides sufficient planning time and empowers teachers in a collaborative environment where they are supported is a key component to reducing attrition and creating a climate where students can be successful (Hirsch, Emerick, Church, & Fuller; 2006).

School Environment.

The school environment includes the physical building, the teaching assignment and the location in which the teacher works. This combination of environmental factors can lead to overall dissatisfaction and eventual loss of an individual teacher, as well as overall satisfaction and the retention of an individual teacher. The facility, equipment and supplies that make up the physical elements of teaching sets the stage for the experience a teacher will have each day. If the school is unsafe or unhealthy, or if the equipment and supplies are inadequate, teachers are forced to focus their attention away from instruction and towards adjustment to the physical environment (Boyd et al., 2009; Buckley, Schneider, & Shang, 2005). Building issues raise numerous concerns for teachers. Many teachers leave their positions in underserved populations because they can find jobs in schools where they have actual classrooms to teach in as opposed to a module or a sectioned-off portion of the cafeteria or media center (Meyer, 2003). In 1995, the U.S. General Accounting Office (GAO) studied the state of school facilities and found many school deficiencies that might affect the quality of instruction. The data showed that 54% of schools at the time did not have adequate space for quality instruction, and 40% of these schools

could not meet the functional requirements for laboratory science classes. To date, the U.S. GAO has not completed a follow-up study to this report.

In addition to facility problems, teachers report feeling frustrated with inadequate classroom resources needed for effective instructions and the out-of-pocket expense incurred in order to compensate for the lack of materials (Boyd et al., 2009; Cullis, 2009; Hughes, 2012; Meyer, 2003; Moore, 2012). Instruction becomes difficult without the necessary tools for laboratory work; as a consequence, teachers are forced to spend their own money on laboratory supplies (Boyd et al., 2009; Cullis, 2009; Meyer, 2003). Teachers need ample materials and supplies to properly educate their students. In some instances, particularly underserved populations, they are expected to perform up to standard with very little in the classroom beyond a textbook, and that may be out of date (Meyer, 2003). Many times, teachers spend their own money to purchase basic classroom materials such as pencils, pens, paper, transparencies and other supplies (Meyer, 2003; NEA 2003). Science teachers spend an average of \$500 annually on instructional materials (NEA, 2003). This practice is so common that workshops on how teachers can effectively equip their classrooms on a budget are available. Such programs are nicknamed “Wal-Mart Science” and “Science on a Shoestring” (NSTA, 2005). Providing teachers with proper equipment and materials to teach is one reasonable and easy solution to the teacher retention issue (Lynch, 2010; Meyer, 2003; Moore, 2012). Hence, sufficient funding to ensure that teachers have amenities and resources needed to do their jobs successfully are indispensable and becomes even more crucial as they gain experience.

Wynn, Carboni, and Patall (2007) identified that working conditions, a component of school climate, are related to novice teachers’ decisions to remain at their schools. Hirsch, Emerick, Church, and Fuller (2006) did a comprehensive review of teacher working conditions

and their research generated similar findings. Teachers with favorable working conditions tend to be better teachers, and this leads to increased student achievement. Such circumstances have been known to play a significant role in teacher efficacy (Hughes, 2012).

Efficacy

Self-efficacy, as proposed by Albert Bandura (1997, 1986) is a belief in one's capability to systematize and implement the course of action required to manage a probable situation.

Bandura (1986) believed that how people behave is directly related to what they think, believe and feel. He proposed that efficacy beliefs were powerful predictors of behavior since they were ultimately self-referent in nature and directed towards specific tasks (Bandura, 1986).

Researchers of self-efficacy (Klassen & Chiu, 2010; Pas, Bradshaw, & Hershfeldt, 2012; Skaalvik & Skaalvik, 2007) define it as an individual's belief in their capabilities to successfully carry out a particular course of action.

According to Bandura (1997), self-efficacy is derived from four sources: mastery experiences, vicarious experiences, verbal experiences, and affective and physiological states. Mastery experience is the most influential of these sources. Mastery experiences are episodes in which teachers demonstrate to themselves that they are capable instructors and are enriched through social validation that connects student outcomes to teacher actions (Ross & Bruce, 2007; Woolfolk-Hoy, 2000). Vicarious experiences are occurrences in which the skill in question is modeled by someone else. The degree to which the observer identifies with the model controls the efficacy effect on the observer. The closer the observer identifies with the model, the stronger the impact will be on the observer's self-efficacy (Woolfolk-Hoy, 2000). Verbal experiences are those involving direct feedback from a colleague or supervisor. While verbal experiences are limited in its power to substantially influence self-efficacy, it can contribute

(Woolfolk-Hoy, 2000). The last source of efficacy development identified by Bandura involves physiological states such as stress, fatigue, anxiety and mood. Individuals oftentimes measure their confidence in relation to the emotional state they have experienced while approaching a task. Positive moods serve to increase efficacy whereas negative moods decrease it (Bandura, 1997; Ross & Bruce, 2007; Skaalvik & Skaalvik, 2007). Highly efficacious people tend to show elevated levels of effort and are resilient in continuing such, even in the face of adversity. As a result, recognizing and increasing a person's self-efficacy could lead them to work harder and in worse conditions than their counterparts with lower self-efficacy. Teacher efficacy is a derivative of self-efficacy directed towards a teacher as an agent of student achievement.

Teacher Efficacy.

Teacher efficacy is an educator's expectation that she or he will be able to bring about change in student learning. A teacher's sense of self-efficacy has been consistently recognized as a significant attribute of effective teaching and has been positively correlated to teacher and student outcomes (Klassen & Chiu, 2010; Pas, Bradshaw, & Hershfeldt, 2012; Hughes, 2012; Skaalvik & Skaalvik, 2007; 2010). Teacher efficacy influences behavior through cognitive, motivational, affective and selection processes (Bandura, 1997; Ross & Bruce, 2007). It is a self-perception, not an objective measure of teaching effectiveness, and develops through reflection on sources of efficacy information (Ross & Bruce, 2007). Research demonstrates that teachers with high self-efficacy generate higher student achievement gains than teachers with low self-efficacy (Hughes, 2012; Pas, Bradshaw, & Hershfeldt, 2012; Ross & Bruce, 2007; Swackhamer, Koellner, Basile, & Kimbrough, 2009).

The effects of teacher efficacy on student achievement can be attributed to several factors. First of all, teachers who score high on efficacy measures are more likely to try out new

ideas, techniques, and methods that involve risk and require student autonomy. The uses of such strategies contribute to heightened success (Hughes, 2012; Ross & Bruce, 2007; Skaalvik & Skaalvik, 2007; 2010; Swackhamer, Koellner, Basile, & Kimbrough, 2009). Secondly, highly efficacious teachers use efficient classroom management techniques that stimulate student independence (Pas, Bradshaw, & Hersfeldt, 2012; Skaalvik & Skaalvik, 2007; 2010). Third, higher efficacy teachers are more productive because they pay close attention to the needs of lower ability students and set high academic standards (Pas, Bradshaw, & Hersfeldt, 2012; Ross & Bruce, 2007). These students are more influenced by the teacher's expectations. Fourth, teacher efficacy leads to changes in teacher behavior which modify students' perceptions of their academic abilities (Pas, Bradshaw, & Hersfeldt, 2012; Ross & Bruce, 2007; Skaalvik & Skaalvik, 2007; Swackhamer, Koellner, Basile, & Kimbrough, 2009). They are more likely to experiment with various teaching strategies to enhance instruction and spend greater amounts of time in lesson preparation, instructional planning and organization. Finally, teacher efficacy contributes to student achievement through persistence. Highly efficacious teachers tend to view student failure as an incentive to increase their efforts (Ross & Bruce, 2007). These teachers work longer with students that struggle, recognize their errors and attempt teaching methods such as inquiry and other student-centered lessons (Ross & Bruce, 2007; Swackhamer, Koellner, Basile, & Kimbrough, 2009).

Personal attributes contribute to feeling efficacious, but organizational factors can also lend themselves to creating an environment that is conducive to these feelings (Klassen & Chiu, 2010; Pas, Bradshaw, & Hersfeldt, 2012). A strong sense of efficacy for teachers is the opportunity to participate in decision-making. Teachers who feel they can positively impact their environment validate their own competency. Teacher efficacy is also influenced by school

climate and collegial interactions (Hughes, 2012; Klassen & Chiu, 2010; Pas, Bradshaw, & Hershfeldt, 2012; Ross & Bruce, 2007). Research also links teacher effectiveness to student achievement and successful school improvement initiatives (Pas, Bradshaw, & Hershfeldt, 2012). Teachers who are highly efficacious tend to remain in the profession; they report a greater enthusiasm for teaching, to teaching and a desire to remain in teaching (Pas, Bradshaw, & Hershfeldt, 2012). One might infer that teacher efficacy is positively correlated to retention, but a review of some literature implies just the opposite. Anita Woolfolk-Hoy (2000) conducted research that concluded efficacy beliefs are established during a teacher's formative years and are somewhat resistant to change. However, recent findings have demonstrated opposite results; teacher efficacy increases during the inductee years but declines around the midpoint of an educator's career (Klassen & Chiu, 2010; Woolfolk-Hoy, 2000; Woolfolk-Hoy & Bourke-Spero, 2005). Other researchers have found a negative correlation between years of experience and teacher efficacy (Ghaith & Yaghi, 1997), and existing investigations have concluded that a nonlinear relationship exists between a teacher's years of service and teacher efficacy (Day & Gu, 2007; Klassen & Chiu, 2010). More research needs to be done on the true relationship—if it can be known—between a teacher's years of experience and teacher efficacy.

Science Teacher Efficacy.

“Scientific literacy” is a phrase that is often used, but lacks a concrete definition (Holbrook & Rannikmae, 2009; Ratcliffe & Millar, 2009; Roberts, 2007). Douglas Roberts (2007) describes scientific literacy as a continuum with two distinct visions. Vision I refers to the products and processes of science itself and Vision II refers to the character of situations with a scientific component that students are going to encounter as citizens. Vision I is literacy within science and Vision II is literacy about science-related situations. What researchers do agree

upon is that scientific literacy is composed of three strands: (a) knowledge of scientific concepts, (b) basic understanding of scientific processes and the nature of the knowledge produced, and (c) awareness of scientific research in context and its influence on day to day life (Holbrook & Rannikmae, 2009; Ratcliffe & Millar, 2009; Roberts, 2007). For teachers, scientific literacy must be operationalized in the form of standards and objectives, instructional practices, evaluation and assessments (Holbrook & Rannikmae, 2009; Ratcliffe & Millar, 2009).

The main objective of recent science education reform research is the preparation of science teachers in a rapidly evolving era of science and technology. The success of these reform studies depends on the capability or the efficacy of the teachers. Teachers who are confident in their comprehension of science content make more time to properly teach science tend to have higher efficacy. They incorporate high-level inquiry activities and student-centered lessons, which can result in higher student achievement (Azar, 2010). By contrast, teachers who are not confident in their capacity to teach science rely on teacher-centered methods of instruction (Azar, 2010).

While a novice can enter the profession with a belief in teaching science as inquiry, said beliefs may not align with the reality of the classroom. This is due to a variety of factors including limited content knowledge, changing beliefs, and an inadequate repertoire in the subject being taught (Luft, Firestone, Wong, Ortega, Adams, & Bang, 2010). A way to bridge the gap between these factors is the inclusion of science-specific professional development (Klassen & Chiu, 2010; Luft, Firestone, Wong, Ortega, Adams, & Bang, 2010; Ross & Bruce, 2007).

Professional Development

Due to the increasing impact of STEM (Science, Technology, Engineering and Mathematics) initiatives in today's society, making science relevant in the classroom is a key aspect of science education in the 21st century. Achieving such reform that effectively addresses this issue is complicated and cannot be accomplished by simply introducing new materials or gadgets in the science classroom. The recommendations for improvement include the importance of ongoing professional development of science teachers in order to achieve the vision of the desired reform (Dass & Yager, 2009; Johnson & Marx, 2009). Professional development is an opportunity to develop new knowledge, skills, abilities, approaches and dispositions to improve a teacher's effectiveness in their classroom (Loucks-Horsley, Hewson, Love, & Stiles, 1998).

Professional development is one way that a teacher can use to grow in the teaching profession. In ideal circumstances, a teacher incorporates the knowledge gained from a professional development program and applies that knowledge to be a better teacher. Loucks-Horsley et al. (1998) went one step further in specifying what constitutes an effective professional development plan. Such a program (a) is driven by a well-defined image of effective classroom learning and teaching; (b) provides opportunities for teachers to build their knowledge and skills; (c) uses or models the strategies teachers will use with their students; (d) builds a learning community; (e) supports teachers as leaders; (f) provides links to other parts of the educational system; and (g) allows for continuous self-assessment. This model is supported in other research (Banilower, Heck, & Weiss, 2005; Dass & Yager, 2009; Johnson & Marx, 2009; Wayne, Yoon, Zhu, Cronen, & Garet, 2008).

Traditionally, professional development was packaged into an afternoon or a day-long inservice taught by an outside expert and designed to be a quick-fix for supposed teacher inadequacies and incompetence. While training-based workshops may be useful for delivering certain types of information, such as instructional methods or specific skills like on how to use a software package, they are derided for their widespread use as the dominant channel of professional development in diverse contexts (Dass & Yager, 2009; Wayne, Yoon, Zhu, Cronen, & Garet, 2008). These one-time events are supposed to develop what a teacher is supposed to learn. The assumption is that these objectives parlay into certain behaviors that are considered valuable to classroom practice and teachers can modify their own classroom performance to this “new” approach.

These opportunities are described as linear or top-down in approach and employ a “sit and get” strategy where teachers are treated as passive recipients of knowledge. They are too brief in duration and too shallow in content to provide any substantive change in teacher practices (Banilower, Heck, & Weiss, 2005; Dass & Yager, 2009; Johnson & Marx, 2009; Wayne, Yoon, Zhu, Cronen, & Garet, 2008). This one-shot delivery method to professional development continues in many school districts and focus on discrete topics such as classroom management, computer-based instruction, student motivation, and assessment. The connection and implementation to the classroom is left up to the individual teacher’s discretion. Such episodic inservice experiences are disconnected from practice. They do not allow teachers time to have serious, cumulative study of their specific subject matter or for modeling new ideas in the classroom and reflecting on the results (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009). Without carefully planned professional development programs, school districts will not have effective teachers who can produce student achievement results.

Making science relevant in today's classroom requires an environment where students can be actively engaged in making meaning of the content in relevant context. Teachers need to learn how to create such an environment and employ strategies that encourage engagement. These abilities cannot be developed through quick-fix in-services. They require carefully designed, sustained professional development that actively involves teachers in the learning process. Such events are far more effective than traditional practice. Restructuring professional development to make it useful to science teachers is essential to the broader efforts of science education reform (Banilower, Heck, & Weiss, 2005; Dass & Yager, 2009; Johnson & Marx, 2009).

Darling-Hammond et al. (2009) review of professional development research showed that intensive professional development, especially when it includes application of knowledge to teacher planning and instruction, has a greater chance of influencing teacher performance and as a result, leads to gain in student learning. The duration of professional development appears to be associated with a positive impact on teacher and student learning because such sustained efforts typically include applications to practice, collaborative study groups and peer coaching (Darling-Hammond et al., 2009; Dass & Yager, 2009; Heller, 2004; Johnson & Marx, 2009). Studies that have implemented intensive, sustainable professional development have found, on average, teachers who participate in it experience the greatest amount of professional change (Banilower, Heck, & Weiss, 2005; Wayne, Yoon, Zhu, Cronen, & Garet, 2008).

Research shows that professional development which is specifically designed around what teachers need, request and want tends to be far more effective than standard specialization-free in-services (Darling-Hammond et al., 2009; Dass & Yager, 2009; Heller, 2004; Johnson & Marx, 2009). Daniel Heller (2004) says that the best meaningful professional development is

one where teachers are asked what they want to learn, what they need to learn, and what they feel is valuable to learn. Once these questions are answered, then the school district and/or school can design an effective professional development program; one that is continuous and consequential. Heller says, “Listen to teachers. Don’t decide their needs for them” (p. 58).

The research supports the idea that meaningful professional development prepares teachers to be better teachers (Darling Hammond et al., 2009; Heller, 2004). Teachers who are prepared to handle the rigor of the classroom tend to remain in teaching (Banilower, Heck, & Weiss, 2005; Darling Hammond et al., 2009; Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Heller, 2004; Kelley, 2004; Meyer, 2003; Wayne, Yoon, Zhu, Cronen, & Garet, 2008; Wynn, Carboni, and Patall, 2007). As such, schools and school districts must consider implementation of structured professional development programs if they want to retain their teachers (Buchanan et al., 2007).

Gender Differences

Within the past decade, there has been little science education research focused on gender differences from the perspective of teachers. Most of the available gender-related literature covers differences from the perspective of students. However, Huang and Fraser (2009) investigated gender-related differences in the school environment and found statistically significant differences in most aspects of the environment. Female science teachers perceived greater collegiality among teachers, higher gender equity among students, and stronger professional interest. Male science teachers perceived lower work pressure and better teacher–student relations. Gender differences in science teachers' perceptions of collegiality, work pressure, and gender equity in the school environment persisted even after controlling for teachers' background and school characteristics.

Scantlebury and Baker (2007), in their review of gender issues in science education research, emphasized the necessity of further studies that focused on teacher attitudes towards gender roles and practices. In particular, Scantlebury (2012) noted the lack of gender studies that examine science teacher background, attitudes, practices and career trajectories, citing Huang and Fraser's (2009) study as one of the few exceptions.

Several smaller-scale studies have used qualitative methods to examine science teachers' attitudes toward gender equity. Using case study research, Andersson, Hussénius, and Gustafsson (2009) found that teachers reasoned more acutely and produced innovative interpretations of the impact of gender stereotypes on their teaching when gender theory was used as a theoretical lens. Zapata and Gallard (2007), also using case study research that focused on one female science teacher, found that this teacher felt that she could leave her female students alone to engage with science in order to focus on the male students, ultimately reinforcing gender stereotypes. Recently, Odogwu, Adeyemo, Jimoh, and Yewonde (2011) investigated gender differences among science, mathematics, and technology teachers with regards to nine school environment variables as well as the association of these variables with teachers' professional background and school characteristics. A questionnaire was used to collect data from a sample of 275 female and 260 male teachers. Gender differences were found on the combined nine variables, and significant differences were found in principal leadership, staff freedom, teacher-student relationships and work pressure. After controlling for teacher background and school characteristics, gender differences in regard to work pressure and principal leadership persisted.

As there is a deficit of research on gender differences in science teaching from the perspective of science teachers, there is definitely room for more investigations in this area in

both qualitative and quantitative formats. More study on if and how gender differences play a role in a science teacher's work experiences is needed before any definitive claims can be made.

Summary

This chapter reviews the current literature in the areas of teacher attrition, retention in urban schools, and science education reform. The identified constructs of school climate, teacher efficacy, and professional development were deconstructed through a review of the research from the past decade and linked to current studies on science teacher retention. The research strongly indicates that there may be a possible link between school climate, teacher efficacy and professional development and science teacher retention in urban schools. Some of the research suggests that the nature of the connection between these factors is not necessarily linear or positive. There is not nearly enough literature in this area, so definitive claims cannot be made.

The current study seeks to discover if statistical relationships exist between these factors and a high school science teacher's years of experience in an urban school, and if there are gender differences in the perceptions of these science teachers as they relate to these factors. If such a relationship can be determined, then this research can add to the existing literature regarding science teacher retention in urban schools. The next chapter of this dissertation, Chapter Three, will review the theoretical and methodological perspectives used to guide this study and the methods that will be used in data collection and analysis.

CHAPTER THREE: METHODOLOGY

Overview

The current study intends to determine if statistical relationships exist among school climate, teacher efficacy, professional development and a science teacher's years of teaching in an urban school. To see if a link existed, a questionnaire was administered to secondary urban science teachers through an online survey company and analyzed using correlational statistics. This chapter will review the theoretical and methodological underpinnings best suited for this investigation. The method will be described, including participant selection, instrumentation, and data collection and analysis procedures. A disclosure of relevant ethical considerations as well as limitations of the study and a chapter summary will be included.

Philosophical Perspective

Foundation

According to Michael Crotty (1998), there are four fundamentals indispensable for developing research: (a) the epistemology; which is a theory of knowledge, a way of understanding how we know what we know, (b) the theoretical perspective; which is the philosophical stance or the context in investigating a topic, (c) the methodology; which is the approach or plan of attack, commonly known as the research design, and (d) the methods; which

are the techniques and procedures used to gather data. Each of these necessary elements serves to inform the other to build the ideological structure of the study.

The epistemology for this study is objectivism. Objectivism is the notion that things exist as meaningful entities independently of consciousness and experience; that such things have meaning and truth residing in them as objects and that careful research can obtain that objective truth and meaning (Crotty, 1998). An important metaphysical position that objectivism makes is that the world is real, that it is structured, and that its structure can be modeled for the learner. There is an objective reality that humans as learners assimilate (Jonassen, 1991). Proponents of objectivism believe that reality exists as an impartial declaration; facts are facts, sovereign of one's hopes, wishes, feelings or fears (The Ayn Rand Institute, 2007). Things are what they are, independent of a person's consciousness. Opponents of objectivism think that it is indifferent to place and context, and that intangibles cannot be fully objectified. Human beings and their environment are viewed as two separate and distinct entities that do not impact one another (Anastasia, 2013).

Postpositivism is a theoretical perspective that reflects a deterministic philosophy in which causes probably determine effects or outcomes (Creswell, 2009). The knowledge that develops through a postpositivist lens is based on careful observation and measurement of the objective reality that exists (Creswell, 2009). Postpositivism is the supposition that researchers cannot be assured absolute certainty about claims of knowledge when studying human behavior and actions. Knowledge is conjectural and evidence established in research is always imperfect. Data are collected in order to build evidence to support or refute a theory, and such verification established in research is fallible (Creswell, 2009; Hesse-Biber & Leavy, 2006). In other words, postpositivism infers that no matter how accurate or stringent a scientist adheres to standard

investigative methods, products of research are neither completely objective nor indisputably certain, and claims to validity are tentative at best (Crotty, 1998). Postpositivists believe that reality cannot be known with total conviction, but it can be approximated.

The rationale for postpositivism as the theoretical perspective in this investigation is due to the collection of quantitative data and the resultant conclusions that can be transferred from a sample to a population. The data will generate a shared reality of science teachers who work in urban schools, but the researcher will not be able to state with absolute certainty exactly what that shared reality is.

Methodological Perspective

Correlational research methods are used to assess relationships and patterns of relationships among variables in a single group of subjects (Ary, Jacobs, & Sorensen, 2010). Correlational research allows for prediction because one can use one variable to forecast the other; the higher the correlation, the better the prediction (Ary, Jacobs, & Sorensen, 2010). One of the reasons why correlational research is carried out is to clarify understanding of important phenomena by identifying relationships among variables. They do not establish cause and effect (Creswell, 2009). This research study employs a non-experimental design that requires a correlational study to determine if a connection exists among school climate, teacher efficacy, and professional development and a science teachers' years of service in an urban school system. Few studies that center on teacher retention have utilized quantitative techniques in data collection and analysis because the focus is on the quality of the data rather than the quantity. It is difficult to generalize qualitative data; however, the researcher believes that the aforementioned factors are related to teacher retention and can be conveyed across a population. This is the reason for conducting a non-experimental investigation.

Surveys

The purpose of a survey is to provide statistical estimates of the characteristics of a target population (Dillman, 2009; Fowler, 2009). Surveys can supply a numerical description of trends in a population by studying a sample and they allow for population transferability. Surveys can provide large amounts of data in a short period of time with minimal cost. Two fundamental premises of the survey process are (a) by describing the sample of responses, one can describe the target population, and (b) the answers given can accurately describe characteristics of the respondents (Fowler, 2009). From this, two main sources of error arise: (a) sampling and (b) bias. Sampling errors result from the fact that data are collected from a sample and not the individuals of a population. Bias is when respondents' answers differ significantly from the target population as a whole (Fowler, 2009).

The Internet has become a popular tool for survey research. Web surveys provide links (URLs) in an email that lead potential respondents to a web page to complete the surveys (Ary et. al, 2010; Dillman, 2009; Fowler, 2009, Shih & Fan, 2008). The instrument is placed on a website and the respondents are able to answer and submit the questions online. Web-based surveys have a number of advantages. They have the potential to reach large populations and permit collection of large amounts of data than is possible with traditional methods. They can be conducted quickly and easily and are far less expensive than mailed surveys (Ary et. al, 2010; Dillman, 2009; Fowler, 2009). Web-based surveys also reduce the amount of time and effort in data processing. Plus, respondents can reply when they want to and there is little chance of misplacing the survey, as is easy to do with mailed questionnaires (Ary et. al, 2010; Fowler, 2009).

Even though web-based surveys are useful and cost effective, there are a number of significant challenges when employing one in data collection. The main one is the lack of or minimal access to the Internet for the general population. According to Dillman (2009), 71% of the population uses the Internet occasionally, and of this percentage, 47% had the high-speed connection required to use an online survey. This means that 29% of the population are left out of web surveys altogether, and 53% of those who can participate lack the level of service required for access to the survey. Even if every household had appropriate Internet access, there is no sampling frame or list of every member of the population. There is no known technique for sampling in which every household has an actual chance of being included in web-based research. This is due to the variety of email address structures; no formal standard exists (Dillman, 2009). The large number of potential responses in a web-based survey does not overcome the problem of sampling error due to the lack of true representativeness (Ary et. al, 2010; Dillman, 2009).

Another significant disadvantage of survey research is participant non-response. If there is not enough data collected, the data will have little to no relationship to the population and will produce results that are not credible (Dillman, 2009; Fowler, 2009). High response rates are desirable and an important criterion by which the quality of a survey is judged, because a higher response rate implies less potential non-response bias (Shih & Fan, 2008). Another factor that affects results is that people who are interested in the subject being studied are more likely to respond than those who are not. Therefore, low response rates may be significantly biased (Dillman, 2009; Fowler, 2009).

Variables

The dependent variable for this investigation is a science teachers' years of experience in their current urban classroom. This is used to measure retention. The independent variables are: (a) school climate, (b) teacher efficacy and (c) professional development. The hypothesis for this study is that a statistical relationship exists among the independent and dependent variables. The null hypothesis is that there is no relationship amongst these variables. Multiple regression is a correlational procedure that examines the connection among several variables. Specifically, this technique enables researchers to find the best possible combination of two or more independent variables to yield a maximum correlation with a single dependent variable (Ary et. al, 2010; Olejnik, 2005). The following is the regression model used for interpretation and prediction of such relationships:

$$Y' = a + b_1X_1 + b_2X_2 + b_3X_3$$

where a , b_1 , b_2 , and b_3 are slopes. X_1 is school climate, X_2 is teacher efficacy and X_3 is professional development. Statistical programs produce a prediction equation with the predictor variables weighted appropriately to yield a high correlation. They also produce a coefficient of multiple correlation, which indicates the relationship between the predictor variable in combination with the criterion.

Stepwise regression is a model-building technique which finds subsets of predictor variables that most adequately predict responses on a dependent variable by linear regression, given the specified criteria for accuracy of model fit. This can be achieved by testing one independent variable at a time and including it in the regression model if it is statistically significant. Variables are entered into the regression equation one at a time. Selection is based on the descending order of the largest significant correlation coefficient. Independent variables

are entered into the regression model until a criterion does not uniquely influence the dependent variable (Olejnik, 2005).

The stepwise method computes the correlation between each potential predictor with the criterion. The predictor with the highest correlation is selected in the first step. But when a variable is added to the model, all other previously added variables are re-evaluated. Variables can be dropped and added back into the model later. Stepwise continues adding and deleting variables until the addition of new variables do not increase or reduce the R^2 statistic significantly. However, the drawback of stepwise regression is that the solution is unstable. If the model were replicated, a different subset of predictors would be identified and the order of variables entered will vary (Olejnik, 2005).

The regression uses the F test to investigate whether independent variable(s) if any, uniquely influence the dependent variable. The R^2 , or the multiple correlation coefficient, is reported to decipher how much variance can be accounted in the dependent variable from the independent variables (Statistics Solutions, 2010). The F test is designed to test if two population variances are equal by comparing the ratio. If the ratio is 1, then the variances are equal.

Method

Participants

This study used purposive sampling. A purposive sample is selected in a deliberate and non-random fashion in order to achieve a certain goal. The sample drew from participants from four urban school districts in the southeastern United States. School data and teacher contact information were obtained through careful searching of the district websites that listed school profiles. The schools that were selected fall under the definition of an urban school established

in Chapter One. According to this definition, these urban schools have approximately 50% students on free and reduced lunch, have large multi-ethnic populations, are located within a greater metropolitan area, and have larger enrollments than their suburban and rural counterparts (Center for Technology Education, 2006; Freedman & Appleman, 2009; Robertson & Ward, 2006; Yendol-Hoppey, Jacobs & Dana, 2009).

Communities within these school districts are serviced by a high school, which is fed by two to three middle schools from multiple elementary schools. This is called a cluster, and each cluster is named for the high school which services it. Urban clusters were determined based on their proximity to the metropolitan area, their enrollment counts, and whether they met the aforementioned criteria for urban school classification. Specifically, preference was given to clusters in close proximity to the metropolitan area with enrollment counts that exceeded 1800 students. Further analysis revealed that the clusters had an average of 59% of their students on free and reduced lunch and large diverse student bodies. There were 35 clusters available for this investigation. The selection requirement for teacher participation was a minimum of five years teaching science. There was an available sample of 223 science teachers with a minimum of five years' experience in the science classroom.

Procedure

Creswell (2009) and Dillman (2009) propose a four-phase survey administration process. According to Dillman (2009), multiple contacts to survey respondents is the most effective way to increase response rates. But since there is very little research on the optimal combination of contacts to use, Dillman (2009) suggests that the administration process can be modified. Elimination of the prenotice is a legitimate alteration of the procedure and researchers can start the survey implementation process immediately through the first contact email. Dillman (2009)

also suggests that each participant be contacted individually to personalize the experience and increase response rates. This also allows each individual's access to the questionnaire to be coded to ensure anonymity, and allows for their responses to be tracked.

For this study, participants were sent an email introducing the researcher and explaining the purpose of the research study. Included in this introductory email was a link to the survey website. Follow-up emails were sent approximately seven days after the initial mail-out. Second follow-up emails were sent out five to ten days after the first follow-up emails. Final emails were sent approximately four weeks after the initial mail-out. The survey process was completed within six weeks. Adhering to Creswell's (2009) and Dillman's (2009) administration procedures, data collection began March 2, 2012. Initial contact emails were sent out the week of March 2. First follow-up emails were generated during the week of March 9, and second follow-up emails were sent out during the week of March 19. Final reminder emails were generated during the week of March 19, and data collection ended on April 16, 2012. The total number of participants who completed the study was 103 out of 223, which yielded a 46.1% response rate

Instruments

Data for this study were collected using a questionnaire compiled from three instruments: the Organizational Health Inventory, the Science Teacher Efficacy Beliefs Instrument, and the Teacher Activity Scale. Questions about the demographics of the teachers were included at the end of the instrument. A standard teacher demographic questionnaire provided information on a teacher's age, gender, ethnicity, attained degrees and certifications, years of service, and current job assignment. The researcher named the questionnaire the Science Teacher Retention Factors Instrument (STRFI).

Organizational Health Inventory. (School Climate)

The Organizational Health Inventory (OHI), developed by Hoy and Feldman (1987), was used to measure school climate. It was modified by Hoy in 2011 for use in secondary schools. The OHI-S for secondary schools assesses the school climate in which each teacher works. It is a 44-item instrument with seven subscales that describe the behavior of students, teachers and principals. A description of each subscale is found in Table 3.1.

Table 3.1

Dimensions of School Health

Dimension	Definition
Academic Emphasis	The extent to which the school is driven by a pursuit for excellence. High but achievable goals are set; the learning environment is ordered and serious; students work hard and respect those who do well.
Teacher Affiliation	Refers to a general friendliness in the school and a strong affiliation with the school. Teachers feel good about each other, their job and their students. They are committed to both their students and their colleagues and accomplish their jobs with enthusiasm.
Collegial Leadership	Refers to principal behavior that is friendly, supportive, open and guided by norms of equality. The principal sets the tone for high performance by letting everyone know what is expected of them.
Principal Influence	Refers to the principal's ability to affect the action of superiors. The principal is persuasive with and works effectively with superiors, get additional consideration.
Resource Support	The extent to which classroom supplies and instructional materials are available and extra materials easily obtained.
Institutional Integrity	The degree to which a school can cope with its environment in a way that maintains the educational integrity of its programs. Teachers are protected from unreasonable community demands.

Morale	The sense of trust, confidence and enthusiasm and friendliness among teachers. Teachers feel good about each other and, at the same time, feel a sense of accomplishment from their jobs.
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Hoy, 2011

The OHI-S includes statements like, “Teachers are protected from unreasonable community and parental demands,” “Teachers receive necessary classroom supplies,” and “The morale of the teachers is high.” All items are simple descriptive statements related to behavior or activities. Respondents are asked to indicate the extent to which the statement characterized their school along a four-point Likert scale with response categories “rarely occurs,” “rarely occurs,” “often occurs,” and “very frequently occurs.” Responses are scored by assigning a 4 to positively phrased statements receiving a “very frequently occurs,” a 3 to “often occurs,” a 2 to “sometimes occurs,” and a 1 to “rarely occurs”. Negatively worded items (8, 15, 20, 22, 28, 29, 30, 34, 36, & 39) were reverse scored with a 4 assigned to “rarely occurs.” Each item is scored for each respondent and then an average school score is calculated for each item. This score represents the average school item score.

Measures of these seven dimensions were combined to provide an overall index of general school health. The higher the score, the healthier the school (Hoy & Sabo, 1998). Factor analytic procedures were conducted to establish construct validity. Hoy and Sabo reported that all dimensions of the organizational health inventory had high construct validity. Cronbach’s alpha was used to measure the reliability of the OHI-S and the alpha coefficient is 0.89. Hoy (2011) reports the following alpha coefficients of reliability for the subscales of the OHI-S: Teacher Affiliation, 0.94; Academic Emphasis, 0.94; Collegial Leadership, 0.94; Resource Support, 0.93; Principal Influence, 0.94; Morale, 0.92; and Institutional Integrity, 0.93. Based upon these figures, all seven subscales have high degrees of reliability.

Research Question One asks if a statistical relationship exists between school climate and the retention of science teachers in urban schools. According to Wynn, Carboni and Patall (2007), and MacNeil, Prater and Busch (2009), a healthy school climate refers to an environment that is conducive to student achievement. Such environments support teacher collegiality, autonomy, and promote respect to and within the profession. These schools have positive administrative support, high teacher morale, and open lines of communication between the principal, administrators and teachers. The OHI-S is a measure of organizational health and it has subscales which address the aforementioned characteristics. As a result, it is an acceptable instrument to use in measuring school climate (Henderson et. al, 2005; Hoy & Woolfolk, 1993; Smith, 2002).

Science Teaching Efficacy Belief Instrument. (Teacher Efficacy)

The Science Teaching Efficacy Belief Instrument (STEBI-A) is a self-report questionnaire developed by Riggs and Enochs (1990). The survey measures a teacher's perception of his or her own effectiveness as a science teacher, as well as the perception of his or her power to control student outcomes. The STEBI has 25 items, which are divided into two subscales: the Personal Teacher Efficacy Scale (PTE) and the Outcome Efficacy Scale (OE). The two factors are uncorrelated (Riggs & Enochs, 1990), hence they measure two different constructs. Table 3.2 is a summary of the STEBI's two dimensions.

Table 3.2

Dimensions of Teacher Efficacy

<u>Dimension</u>	<u>Definition</u>
Personal Teacher Efficacy	Refers to supervisory style, which may be defined in terms of task-oriented behavior and person-oriented behavior. Task-oriented behavior requires direction and coordination of group activities to achieve the goals of the organization. Person-oriented behavior requires trust, respect, support,

Outcome Efficacy	friendship, openness, and attempts to improve the environment. The teaching work group and the social aspects of the school setting.
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Riggs & Enochs, 1990

The STEBI self-reports statements like “I am continually finding better ways to teach science,” “I am typically able to answer students’ questions,” and “Given a choice, I would not invite the principal to evaluate my science teaching.” The questionnaire uses a Likert scale format with response categories "strongly agree," "agree," "uncertain," "disagree," and "strongly disagree." Responses were scored by assigning a 5 to positively phrased statements receiving a "strongly agree" response, a 4 to "agree," a 3 to "uncertain," a 2 to "disagree," and a 1 was assigned to items that received a "strongly disagree" response. For those items that were negatively phrased (items 3, 6, 8, 10, 13, 17, 19, 20, 21, 22, 24 and 25) a reverse score was used with a 5 being assigned to "strongly disagree." Item scores for each dimension were added to calculate two separate scale scores for each respondent. Riggs and Enochs (1990) evidenced validity by conducting repeated factor analysis resulting in item-total correlations of 0.50 and above for all items. The reliability analysis for the Science Teaching Outcome Expectancy scale resulted in an alpha of 0.73. Reliability for the Personal Science Teaching Efficacy Belief Scale was reported at 0.91.

Research Question Two asks if a statistical relationship exists between teacher efficacy and science teacher retention in urban schools. The STEBI has been used frequently in science teacher efficacy research (Arigbabu & Oludipe, 2010; Eddy & Easton-Brooks, 2010; Parlo, 2007). It is a reliable instrument to use to measure science teacher efficacy.

Teacher Activity Survey. (Professional Development)

The Teacher Activity Survey (TAS) was developed by Garet, Porter, Desimone, Birman and Yoon to use in a three-year longitudinal study (2001). They isolated two key features of professional development that could be considered effective in improving teacher practice. They are structural features and core features. Structural features include the organization of the activity and core features are characteristics of the substance of the activity. National teacher data determined that these features are related to increases in teacher skills and knowledge and positive changes in teacher practice (2001).

The TAS uses a combination of question types, including a five-point Likert-scale format where respondents are asked to rate their professional development experiences, and a yes/no dichotomy where respondents denote what kinds of professional development they have participated in. It asks questions like, “Have you attempted to adjust your teaching practices because of your participation in professional development activities,” “Do you feel that your knowledge and skills have been enhanced in each of the following levels as a result of your participation in professional development,” and inquires participants to rate the extent have student learning and engagement improved as a result of their participation in professional development activities. The Teacher Activity Survey does not yield a score. Rather, it produces descriptive data regarding teacher patterns in professional development. It has been used in a variety of longitudinal studies (Desimone et al., 2002; Garet et. al, 2001; Yoon et. al, 2001).

The measures consist of composites. Research indicates that composite indicators have higher validity and reliability than single indicators (Desimone et. al, 2002; Mayer, 1999; Yoon, 2010). Data represent accounting of behaviors, not direct judgments of quality that could be positively biased. The variation in the responses from both the national and the longitudinal data

support the survey's construct and content validity (Desimone et. al, 2002; Garet et. al, 2001).

The TAS has a reliability coefficient of 0.80.

The data from the TAS are relevant and useful if they are classified as ordinal data. If the ordinal data are put into three categories where 1 describes the amount of professional development experiences of five or less, 2 describes the amount of professional development experiences of six to 24, and 3 describes the amount of professional development experiences of 25 or more. This allows for the data to be analyzed in such a way that a statistical relationship can be determined. Since Research Question Three asks if a statistical relationship exists between professional development and science teacher retention in urban schools, the use of the TAS in this method allows for this question to be answered.

Each research question necessitates a different correlation coefficient. Research Question Four seeks to identify the best predictors among the independent variables to years of service in an urban school. In order to accomplish this, a stepwise multiple regression is required. It is possible to do this if one is using both ranked data and quantitative data. The data can be analyzed as if all of the variables are quantitative (Personal Communication with Stephen Olejnik, November 10, 2010). This method allows for Research Question Four to be answered. How all of these factors relate to one another to predict how long a science teacher is retained in the urban classroom will be answered through multiple regression analysis.

Current research on science teacher retention in correlation with the independent variables for this study does not indicate significant differences between females and males in quantitative studies. An independent samples T-test compares the mean scores of two different groups. The two groups are female and male. Research Question Five requires the use of a T-

test to determine if there are differences in gender between each of the three components of the STRFI. It is expected to yield the same results as the current literature base.

Table 3.3 is a data collection matrix that highlights the research questions and the analysis technique required to answer them.

Table 3.3

Data Collection Matrix

Research Question	Variable	Source	Statistical Test
1. Is there a statistical relationship between the retention of urban science teachers and school climate?	School Climate	OHI	Pearson Product Moment
2. Is there a statistical relationship between the retention of urban science teachers and teacher efficacy?	Efficacy	STEBI	Spearman
3. Is there a statistical relationship between the retention of urban science teachers and professional development?	Professional Development	TAS	Spearman
4. What are the best predictors among type of teacher education program, school climate, teacher efficacy, and professional development to science teacher retention in urban schools?	All Variables		Stepwise Regression
5. Are there gender differences between organizational health, science teacher efficacy and professional development?	All Variables		T-test

Adapted from Creswell, 2009

Web surveys are very popular for collecting data. There are a couple of ways to set up a procedure for participants to use a web survey, including self-design and personal hosting. However, this process can be very expensive over time. The most popular technique is to use an inexpensive software application delivered via the Internet through a hosting company. The survey is designed by the researcher using a variety of formats provided by the hosting company, and the software transforms the survey into the proper computer code required to for the web pages and database (Dillman, 2009). Then the survey is hosted on the company's servers. When data collection is complete, the researcher can access the data for analysis through spreadsheets, SPSS, or SAS.

Such hosting companies include Survey Monkey and Zoomerang. Survey Monkey is an electronic survey company that was established in 1999 (Creswell, 2009). It is a very popular hosting company because it is cost-effective, the survey can be easy to navigate, the survey functions are continuously upgraded, the company handles all IT issues, the implementation process is quick and collection is automated, and the website can accumulate and organize the data as well as track responses (Survey Monkey, 2011). The compiled instrument for this research was administered online through Survey Monkey. Survey Monkey generates results of survey data through descriptive statistics and graphs. The data can be downloaded into a spreadsheet or database for further analysis (Creswell, 2009; Survey Monkey, 2011). Data for this investigation were collected online and the software was configured not to record IP addresses or retain email addresses. This procedure kept responses anonymous. The data were encrypted during transmission for further security and stored on secure servers at the web hosting company.

With any type of web survey and hosting company, there are limitations. Survey Monkey provides 17 different survey formats, and although significant, it is restricted. There is the potential for the web survey to be unappealing or confusing to the participants. Good email addresses are required for initial participant contact, and there is the challenge of enlisting cooperation. Also, certain populations are ideal for Internet surveys; usually computer-savvy individuals with proper Internet access and knowledge. This restricts a significant percentage of the population and can increase response bias (Dillman, 2009; Fowler, 2009).

Because of the complexity of this research, a pilot study was necessary. The intent of a pilot study is to anticipate and repair problems in survey implementation and data collection. Because Survey Monkey was utilized to disseminate the information, the study established the best format for the instrument to ensure maximum participation, reduce flaws in data collection, and the most appropriate way to report the results. This practice ensured that the potential for errors in the official implementation have been reduced. Thirty-one participants for the pilot study came from a convenience sample of urban science teachers that were colleagues of the researcher. The pilot study was carried out during the month of October, 2011.

Data Analysis

Standard descriptive statistics were provided, including the mean, the median, the standard deviation and the range of a teacher's years of experience and age. These statistics also include but are not limited to (a) the number of respondents versus non-respondents, both male and female, (b) the percentage of teachers who have been educated in traditional programs versus alternative programs, (c) the percentage of respondents who are teaching in their preferred discipline, (d) and the percentage of teachers who were mentored in a formal program upon arrival to their school. Due to the natural tendency for participant non-response, there was a

large potential for response bias, which can greatly affect the quality of the data that is collected. Wave analysis is the examination of select items on a regular basis to determine if average responses change with additional responses to the survey (Creswell, 2009), so the researcher examined select items from each component of the instrument weekly to track potential responses changes with additional responses to the survey. The questions selected for wave analysis were: (a) Teachers are indifferent to each other (from the OHI-S), (b) I am typically able to answer students' science questions (from the STEBI), (c) Have you attempted to adjust your teaching practices because of your participation in professional development activities, and (d) Insufficient planning time (both from the TAS). The OHI-S question had an average response rate (Strongly Disagree) of 64.2%. The STEBI question had a response rate (Strongly Agree) of 65.7%. The first TAS question had a response rate (Yes) of 94.1%, and the second had a response rate (Yes) of 83.8%. Over the course of data collection, these percentages had very little variance.

Research Question One, which asks if a correlation exists between school climate and years of teaching, classifies the data as interval, because the OHI-S yields a score that can be placed in order at equal intervals. This requires the use of the Pearson product moment correlation. With interval data, the zero point is arbitrary and differences can be reported. The intervals are equal in terms of the instrument itself, but not necessarily of the behavior(s) being measured.

For Research Questions Two and Three, the Spearman rho correlation is required to test the data. Research Question Two asks if there is a correlation between years of teaching and teacher efficacy, and Research Question Three asks if there is a correlation between professional development and years of teaching. The data are ordinal and the Spearman is a non-parametric

measure of statistical dependence. It ranks behavior according to how much of an attribute an individual possesses. Numbers indicate the order of the categories, but the numbers themselves have no meaning.

Research Question Four is intended to determine the best possible predictors of science teacher retention by using the stepwise regression method. Research Question Five is designed to determine if there are significant gender differences on the OHI-S, the STEBI and the TAS by using both an independent samples T-test and a chi-square test. Current research indicates that there are statistical differences between female and male science teachers' perceptions in regards to school climate, science teacher efficacy and professional development, but there are not many quantitative studies to support this.

There should be proper specification of the model in multiple regression. This means that relevant variables must be included in the model to make it reliable. Certain assumptions must be made in order to ensure this. They are (a) linearity, which means that the model should be linear in nature, (b) normality, which means the variables should have a normal distribution, (c) homogeneity, which means that the error variance should be constant, (d) independence, which means that errors associated with the observation are not correlated with errors of any other observation, (e) influence, which is when an individual observation exerts influence on the coefficient, and (f) collinearity, which is when the predictors are highly collinear, or there is a near-perfect relationship between two or more independent variables (Statistics Solutions, 2010) As stated earlier, stepwise methods are the best way to determine if a relationship exists among a predictor variable and several criterion variables because the independent variables are added one at a time and evaluated constantly to achieve the most significant R^2 statistic. What the

stepwise regression method will accomplish in this study is to answer the overall question of what factors contribute to the retention of urban science teachers.

SPSS is the chosen statistical program used in this study because it computes all of the standard descriptive statistics as well as basic statistical tests such as the T-test, ANOVA, Spearman rho and the Pearson r. SPSS also computes correlational data to produce regression lines. Also, SPSS is cost-effective and has a perpetual license, so there is no need for continual renewal and additional cost (Granville, 2010). The research questions call for determination of a relationship between the independent variables and the dependent variable, so SPSS is an excellent program to use for this investigation.

Ethical Considerations

Approval for research was obtained from the Institutional Review Board of the Human Subjects Office at the University of Georgia and school district permission was acquired through an application process. Participants will remain anonymous because their IP addresses and email addresses will not be retained. All responses were encrypted, secured, and stored on the web hosting company's servers.

Summary

The philosophical foundations that guide this research lie in objectivism and postpositivism. Objectivism refers to an investigator's ability to be objective in their research, and postpositivism is the supposition that knowledge claims are not absolute. Therefore, any data generated from this research has the potential to be infallible. The methodology employs correlational research methods to find relationships among variables. Surveys are instruments that can be used to collect correlational data. This study will use a compiled survey distributed

to a convenience sample via the Internet. Descriptions and explanations of the instrument are included within this chapter, as well as details about the web survey implementation process and how the data will be analyzed and reported. The next chapter will describe the pilot study.

CHAPTER FOUR: PILOT STUDY

Overview

A pilot study was undertaken in October 2011 to test the functionality of the science teacher retention factors instrument (STRFI). Data collection lasted for two weeks, and the data were analyzed in December of 2011. The study yielded specific results as to the design of the instrument and the ease of access. The STRFI consists of four separate components: the OHI-S, the STEBI, the TAS, and a demographic questionnaire. The OHI-S has seven subscales, each of which measures a specific component of school health. The STEBI has two subscales that measure science teacher efficacy. The TAS is a measure of how much professional development a teacher has. This chapter will discuss the analysis of the data generated from the pilot study.

Methodology

Setting and Participants

The pilot school is a secondary high school located in the southeastern United States. The school has an enrollment of approximately 3000 students, and a faculty of 230. There were 31 science teachers in the pilot study, and all participated. Twenty-one respondents were females and seven were males, with three participants choosing to skip the gender question. Forty-eight percent of the participants are White, 34% are Black, 7% are Asian, 3% are Latino, and 7% classified themselves as “Other.” The average age was 36 years for female participants,

and 50 years for male participants. The average number of years teaching science for all participants is 15.5. An average of 10.5 years was spent teaching science in an urban school, and the group of participants spent an average of 10.4 years in the pilot study school.

Descriptive Statistics

An independent samples T-test was used to compare female and male data. There was a significant difference between males and females with demographic questions six, seven and nine. Question six asks if the participants' current teaching assignment is their preferred area to teach; which is an indicator as to whether they're teaching out-of-field. The selection choices were "1" for yes, and "2" for no. There was a statistically significant difference in the scores for females ($M = 1.14$, $SD = 0.351$) and males ($M = 1.00$, $SD = 0.000$); conditions $t(21) = 1.82$, $p = 0.023$. The mean for the females was higher than the males. It can be concluded that, within the pilot school, more female participants are teaching out-of-field.

Question seven asks if participants were mentored in formal induction programs when they first arrived at the school where they currently teach (the school in question). The selection choices were "1" for yes, and "2" for no. There was a statistically significant difference in the scores for females ($M = 1.45$, $SD = 0.510$) and males ($M = 1.86$, $SD = 0.378$); conditions $t(14) = -2.24$, $p = 0.000$. The inference that can be made is that the male participants were not formally mentored when they arrived at their current school. The data dovetail nicely with the results of Question nine.

Question nine asks how many years participants have spent at their current urban school. The selection choices were "1" representing zero to five years, "2" representing six to 10 years, "3" representing 11 to 15 years, "4" representing 16 to 20 years, "5" representing 21 to 25 years, and "6" representing 26 years and up. There was a statistically significant difference in the

scores for females ($M = 1.50$, $SD = 0.740$) and males ($M = 2.29$, $SD = 0.149$); conditions $t(7) = -1.38$, $p = 0.014$. The mean for males is higher than females, so the inference that can be made is that the male participants have remained at the pilot school longer than the female participants.

According to the demographic data, which indicate that the men have worked at the pilot school for an average of 12 years, and the women an average of eight years, this inference is supported.

Tying the results of question nine with question seven, one can conclude that the men in this study have remained in teaching longer than the women, in spite of the fact that they have not undergone formal mentoring.

Data Analysis

The OHI-S measures the overall health of a school. Schools with a score of 550 and below are considered unhealthy, and schools with a score above 600 are considered very healthy. For the pilot study, the selected school had a score of 551. According to Hoy and Sabo (1998), the pilot school is considered to be healthy. The Pearson r correlation was used to analyze data from the OHI-S. The resulting correlation is not statistically significant ($r = 0.046$, $n = 31$, $p = 0.806$). The alternative hypothesis is rejected and the null hypothesis is supported.

The STEBI has two subscales, and self-reports using a Likert scale format. The survey measures a teacher's perception of his or her own effectiveness as a science teacher, as well as the perception of his or her power to control student outcomes. In this instance, a science teacher's years of experience are compared to how much of an attribute a science teacher has. The inference is that the better a science teacher perceives herself or himself to be, the more likely they are to remain in teaching. Item scores for each subscale were calculated and a Spearman's ρ was used to analyze the results of the STEBI, as it correlates ranked data. The data are not statistically significant ($r = 0.460$, $n = 29$, $p = 0.012$). According to the results, the

hypothesis is unsupported, as there is no relationship between a science teacher's years of experience and how good of a science teacher they perceive themselves to be.

The TAS has seven subscales that measure the amount and variety of professional development experiences a participant has, as well as its influence on a teacher's instructional methods. It self-reports using both a Likert scale format and a dichotomous (yes/no) format. The TAS produces descriptive data regarding teacher patterns in professional development. With this instrument, a science teacher's years of experience are compared to how much professional development the science teacher has had. The first subscale clarifies the types of science teacher professional development experiences within the framework of the school or district. "1" describes the amount of professional development experiences of five or less, 2 describes the amount of professional development experiences of six to 24, and 3 describes the amount of professional development experiences of 25 or more.

The data from this subscale yielded a statistically significant result ($r = 0.933$, $n = 29$, $p = 0.000$), and the hypothesis is supported. Most of the teachers had six or less professional development experiences. Specifically speaking, the female teachers had an average of 6.36 professional development experiences, and male teachers had an average of 6.43 experiences. Comparing this with years of experience, it can be inferred that professional development plays a role in science teacher retention.

A stepwise multiple regression analysis was conducted to explain the relationship between a teacher's years of experience and various potential predictors. The following is the multiple regression model generated from the data.

$$\hat{y} = 4.813 - 0.027x_1 + 0.017x_2 - 0.013x_3$$

The model produced an $R^2 = 0.174$, and an adjusted R^2 of 0.075. 17.4% of the variance in teaching experience can be predicted by measures of school health, science teacher efficacy, and professional development. Since there is not a statistically significant relationship between the response variable and all of the predictor variables, then the hypothesis for the full model must be rejected.

Findings

The STRFI needed some adjustments. One was the changing of a misspelled word in the STEBI. In the Outcome Efficacy subscale, question two, the word “teaching” should be “teacher.” During data analysis, it was determined that respondents should not be given the option to skip questions because SPSS throws out a data set if there is a missing entry. Three participants elected to skip the gender question. In the OHI-S, two participants skipped questions 1-4 in the Principal Influence subscale, and two people skipped the entire component. One person skipped all the questions in Resource Support, Morale, and Academic Emphasis. In the STEBI, one participant skipped the entire component. Since several participants elected to skip some questions, there were some data sets that were eliminated. Therefore, the results of this study are invalidated because there was no consistency in the number of participant responses. As a result, participants will not be allowed to skip questions in the actual study.

A noteworthy event occurred recently. The Organizational Health Inventory was updated within the last calendar year to include another subscale. This OHI, called the OHI-S, specifically geared for secondary schools, was used instead of the older version previously discussed in Chapter Three.

Conclusion

This chapter described the pilot study that was undertaken to test the efficiency of the STRFI. There were some adjustments that needed to be made to the instrument in order to maximize the validity of the results. One such adjustment is the elimination of whether a participant can choose to skip a question. Respondents cannot skip questions because it leads to invalid results. The data were analyzed with an independent samples T-test, a Pearson correlation coefficient, and a Spearman rho coefficient. None of the instruments yielded statistically significant results. A regression model was generated to determine the best combination of predictors that contribute to science teacher retention, but the model was rejected. A potential reason for the lack of significance is the incomplete data sets that had to be discarded and left a reduced response rate. The next chapter will discuss the findings for the actual study.

CHAPTER FIVE:

FINDINGS

Overview

Chapter Five of this paper details the methods used to analyze the data generated from the Science Teacher Retention Factors Instrument (STRFI). Data were collected over two six-week periods. The first period began March 2012 and ran through April 2012, and the second period began August 2012 and ran through September 2012. This yielded a sample of 103 participants. This chapter is divided into three sections. The first section covers professional and personal descriptive statistics regarding the sample. The second section describes the results of the statistical tests used to answer the five research questions, and the final section reviews the answers to the free response questions. The chapter ends with a summary of its contents.

Results

Sample Demographics

The sample came from a large metropolitan area in the southeast United States. One hundred and three secondary urban science teachers participated in this study. Sixty-eight (66%) respondents were female and 35 (34%) were male. In terms of personal characteristics, Table 5.1 breaks them down by age and ethnicity. The average age of the participants is 40.5 years. Of the participating science teachers, 75.7% are White and 22.3% are Black. Table 5.1 shows the descriptive statistics of the participants' personal characteristics.

Table 5.1

Frequency of Participants' Personal Characteristics by Gender

Personal Characteristic	Female (n = 68)	Male (n = 35)
Age Range		
21-30	3(4)	2(6)
31-40	27(40)	13(37)
41-50	22(32)	10(29)
51-60	12(18)	8(23)
60+	4(6)	2(6)
Ethnicity		
Asian	1(1)	0(0)
Black	16(24)	7(20)
White	50(74)	28(80)
Other	1(1)	0(0)

Note. Percentages are in parentheses and may not total 100% due to rounding. Other ethnic categories such as Latino, Native American and African were not selection choices by the participants, and thus, are not included in this table.

In terms of professional characteristics, Table 5.2 breaks them down by gender and educational level. Data revealed that a majority (90%) of the respondents held a degree higher than a bachelor's. Data also showed that slightly less than half (49%) of the participants held a master's degree, and a fifth (20%) held doctorates (see Table 5.2). Of the respondents, 44.5% taught in the physical sciences, 33% taught in the life sciences, 18% taught in multiple disciplines, and 4.5% taught in the earth sciences (see Table 5.2). The participants spent an average of 10.5 years teaching science, and an average of eight years teaching science in an urban school.

Table 5.2

Frequency of Participants' Professional Characteristics by Gender

Professional Characteristic	Female (n = 68)	Male (n = 35)	Total
Educational Level			
Bachelor	9(13)	3(9)	12
Master	33(49)	17(49)	50

Specialist	18(26)	10(29)	28
Doctorate	8(12)	5(14)	13
Teaching Assignment			
Life Sciences	25(37)	10(29)	35
Physical Sciences	27(40)	17(49)	44
Earth Sciences	5(7)	1(3)	6
Multiple Disciplines	11(16)	7(20)	18
Years Teaching Science			
5	7(10)	2(6)	9
6-10	19(28)	12(34)	31
11-15	20(29)	11(31)	31
16-20	10(15)	2(6)	12
21-25	8(12)	5(14)	10
26-30	2(3)	2(6)	4
30+	2(3)	1(3)	3
Years Teaching Science in Current Urban School			
5	30(44)	15(43)	45
6-10	26(38)	16(46)	42
11-15	8(12)	3(9)	11
16-20	2(3)	0(0)	2
21-25	2(3)	1(3)	3
26+	0(0)	0(0)	0

Note. Percentages are in parentheses and may not total 100% due to rounding. Life Sciences: Biology, Honors Biology, AP Biology, Anatomy/Physiology. Physical Sciences: Chemistry, Honors Chemistry, AP Chemistry, AP Physics, Physics, Honors Physics. Earth Sciences: Astronomy, Ecology, Environmental Science, AP Environmental Science, Oceanography.

The rest of the demographic information breaks down as follows: 81% of the participants reported that they are teaching in their area of expertise, with 19% teaching out-of-field. In terms of time retained at their current location, 40.8% of the science teachers have been at the same school between six and 10 years, 10.7% have remained at the same school between 11 and 15 years, and 4.9% have been in the same school for at least 16 years. In regards to formal induction procedures, 61.2% of the respondents reported that they did not participate in any kind of induction upon arrival to their current place of employment.

The next segment of this chapter analyzes the data from the STRFI, starting with school climate.

Science Teacher Retention and School Climate

Summary of OHI-S data.

Section I of Appendix B is the Organizational Health Inventory for Secondary Schools (OHI-S). The OHI-S was rated using a 4-point Likert-scale format. The rating is as follows: “Rarely Occurs,” “Sometimes Occurs,” “Often Occurs,” and “Very Frequently Occurs.” Hoy and Feldman (1987) grouped the 44 organizational characteristics into seven subscales: institutional integrity, initiating structure, consideration, principal influence, resource support, morale and academic emphasis. Participants were asked to rate their perception of each cluster via a series of individual items. There were between five and nine individual items for each of the seven clusters. The first subscale is Institutional Integrity. It describes a school that has honor and morality in its educational program, and is able to cope successfully with destructive outside forces. There are seven items in this cluster: (a) Teachers are protected from unreasonable community and parental demands, (b) The school is vulnerable to outside pressures, (c) Community demands are accepted even when they are not consistent with the educational program, (d) Teachers feel pressure from the community, (e) Select citizen groups are influential with the board, (f) The school is open to the whims of the public, and (g) A few vocal parents can change school policy. Table 5.3 shows the response distribution of the Institutional Integrity subscale.

Table 5.3

Institutional Integrity

Item	Response				Total
	RO	SO	OO	VFO	
Teachers are protected from unreasonable demands	11	38	44	10	103
School is vulnerable to outside pressures	19	30	39	15	
Community demands are accepted	9	21	46	27	
Teachers feel pressure from the community	9	26	52	16	

Select citizen groups are influential with the board	19	22	38	24
The school is open to the whims of the public	18	17	36	32
A few vocal parents can change school policy	15	31	28	29

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. Of the teachers in this study, 89.3% believe that they are reasonably protected from arbitrary demands. While they may feel protected by the school from outside stressors, 91.3% of the participants do feel some pressure from the community. Furthermore, 81.6% consider their school vulnerable to outside pressures, 91.3% feel that their institution is influenced by inconsistent community demands, and 81.6% believe their school is influenced by select citizen groups. Of the respondents, 82.5% think their school is open to the whims of the public. Finally, 85.4% of the participants believe that vocal parents can affect their school’s policy. For this subscale, there is some inconsistency with the data.

Initiating Structure is the second subscale. The cluster itself describes task- and achievement-oriented behavior as it relates to the principal’s ability to clearly disseminate her or his attitudes and expectations to the faculty. There are five items in this cluster: (a) The principal asks that faculty members follow standard rules and regulations, (b) The principal makes her or his attitudes clear to the school, (c) The principals lets faculty know what is expected of them, (d) The principal maintains definite standards of order, and (e) The principal schedules the work to be done. Table 5.4 shows the response distribution of the Initiating Structure subscale.

Table 5.4

Initiating Structure

Item	Response				Total
	RO	SO	OO	VFO	
The principal asks that faculty members follow rules	0	5	29	69	103
The principal makes their attitudes clear to the school	2	11	34	56	
The principal lets faculty know what is expected	0	10	43	50	
The principal maintains definite standards of order	6	19	38	40	
The principal schedules the work to be done	5	39	34	25	

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. As far as the principal’s insistence that the faculty follows rules and regulations, 100% say it is a regular occurrence. In terms of the principal’s ability to let her or his attitudes and expectations be known to the faculty, 98.1% of the sample says it happens regularly. As far as the principal’s ability to maintain order, 94.2% consider it to be a regular occurrence. In terms of scheduling the work to be done, 95.2% of the participants say it happens regularly.

Consideration is the third OHI-S subscale, and the cluster itself describes principal behavior as it relates to the welfare of the faculty. There are five items: (a) The principal is friendly and approachable, (b) The principal treats all faculty members as her or his equal, (c) The principal puts suggestions made by the faculty into operation, (d) The principal is willing to make changes, and (e) The principal looks out for the personal welfare of faculty members.

Table 5.5 shows the response distribution of the Consideration subscale.

Table 5.5

Consideration

Item	Response				Total
	RO	SO	OO	VFO	
The principal is friendly and approachable	4	26	36	37	103
The principal treats all faculty members as equals	20	33	23	27	
The principal puts faculty suggestions into operation	19	38	32	14	
The principal is willing to make changes	13	30	35	25	
The principal looks out for the welfare of the faculty	15	28	24	36	

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. Of the participants, 96.1% think that their principal is friendly and approachable most of the time. For item (b), 80.5% of the respondents believe their principal treats them as equals. In regards to the personal welfare of the faculty, 85.5% feel that their principal considers it a regular priority. For item (d), 87.4% of the participants reported that their principal is willing to make changes. With regards to implementing faculty suggestions, 81.6% say that their principal does it regularly.

Principal Influence is the fourth subscale. The cluster describes principal behavior as it relates to her or his ability to work effectively with the superintendent while remaining autonomous. There are five items in the cluster: (a) The principal gets what he or she asks for from superiors, (b) The principal is able to influence the actions of his or her superiors, (c) The principal is able to work well with the superintendent, (d) The principal's recommendations are given serious consideration by his or her superiors, and (e) The principal is impeded by the superiors. Table 5.6 shows the response distribution of the Principal Influence subscale.

Table 5.6

Principal Influence

Item	Response				Total
	RO	SO	OO	VFO	
The principal gets what they ask for from superiors	4	45	48	6	103
The principal is able to influence their superiors	12	48	36	7	
The principal works well with the superintendent	2	22	42	37	
The principal's recommendations are considered	6	31	42	24	
The principal is impeded by their superiors	12	24	37	30	

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. Of the participants, 96.1% believe that their principal regularly gets what they ask for from their superiors. In regards to the principal’s ability to influence on the actions of her or his superiors, 88.3% consider their principal as able to do so regularly. The majority of the sample (76.7%) says that their principal works well with the superintendent. In conjunction with this, 94.2% of the respondents think that the principal’s recommendations are often considered by their superiors. In regards to the principal being impeded by her or his superiors, 88.3% say it happens regularly.

Subscale five on the OHI-S is Resource Support. This cluster describes a school where adequate classroom resources, supplies and instructional materials are available and extra materials easily obtained. There are five items in the cluster: (a) Extra materials are available if requested, (b) Teachers receive necessary classroom supplies, (c) Teachers are provided with adequate materials for their classrooms, (d) Supplementary materials are available for classroom use, and (e) Teachers have access to needed instructional materials. Table 5.7 shows the response distribution of the Resource Support subscale.

Table 5.7

Resource Support

Item	Response				Total
	RO	SO	OO	VFO	
Extra materials are available if requested	16	36	34	17	103
Teachers receive necessary classroom supplies	14	32	35	22	
Teachers are provided with adequate materials	16	24	38	25	
Supplementary materials are available for use	12	37	35	19	
Teachers have access to needed instructional materials	5	37	30	31	

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. In terms of the accessibility of extra materials, 84.5% of the participants say that they are regularly available. Of the participants, 86.4% say they have necessary classroom supplies. For the adequacy of classroom materials, 85.4% say they regularly have adequate materials. In terms of supplemental materials, 88.3% claim they have access to said materials. As far as having access to needed instructional materials, 95.1% of the respondents say that they have regular access.

Morale is the sixth subscale on the OHI-S. The cluster describes a school where there is a sense of trust, confidence, enthusiasm and friendliness among teachers. Optimism is high and teachers feel a sense of accomplishment from their jobs. There are nine items in this cluster: (a) Teachers do favors for each other, (b) Teachers in this school like each other, (c) Teachers are indifferent to each other, (d) Teachers exhibit friendliness to each other, (e) Teachers in this school are cool and aloof to each other, (f) The morale of the teachers is high, (g) There is a feeling of trust and confidence among the staff, (h) Teachers accomplish their jobs with enthusiasm, and (i) Teachers identify with the school. Table 5.8 shows the response distribution for the Morale subscale.

Table 5.8

Morale

Item	Response				Total
	RO	SO	OO	VFO	
Teachers do favors for each other	1	10	45	47	103
Teachers in this school like each other	0	16	51	36	
Teachers are indifferent to each other	9	30	24	40	
Teachers exhibit friendliness to each other	1	12	43	47	
Teachers in this school are cool and aloof	16	27	21	39	
The morale of the teachers is high	26	36	34	7	
There is a feeling of trust among the staff	14	34	40	15	
Teachers accomplish their jobs with enthusiasm	6	40	53	4	
Teachers identify with the school	5	38	41	19	

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. The majority of the sample (90.3%) agrees that within their schools, teachers do favors for each other, 84.5% say that they like their colleagues, and 87.4% say that their faculty are friendly to and with one another. There is some variability with items (c) and (e). For the indifference item, (c), 38.8% of the participants say that teachers are rarely indifferent to one another, 23.3% of the respondents say that teachers were sometimes indifferent, and 37.9% say that teachers were often indifferent to each other. For the aloof item, (e), 37.9% of the participants said that teachers are rarely aloof to one another, 20.4% said that their teachers were sometimes aloof, and 41.7% say that teachers are regularly aloof to one another. When it comes to item (f), 74.8% of the participants think that morale is high in their schools. Of the participants, 86.4% believe that there is often a sense of trust and confidence among their staff. In terms of task accomplishment, 94.1% of the respondents say that teachers in their schools regularly accomplish their tasks with enthusiasm. In terms of school identification, 95.2% say they often identify with their school.

Academic Emphasis is subscale seven and it describes a school where high goals are set for students, the learning environment is orderly and serious, teachers believe that students can achieve, and students work hard and have a measure of respect for their peers and teachers. There are eight items in the cluster: (a) The students in this school can achieve the goals that have been set for them, (b) The school sets high standards for academic performance, (c) Students respect others who get good grades, (d) Students seek extra work so that they can get good grades, (e) Teachers in this school believe that their students have the ability to achieve academically, (f) Academic achievement is recognized and acknowledged by the school, (g) Students try hard to improve on previous work, and (h) The learning environment is orderly and serious.

Table 5.9

Academic Emphasis

Item	Response				Total
	RO	SO	OO	VFO	
Students can achieve the goals that have been set	2	32	49	20	103
The school sets high standards for academics	6	15	42	40	
Students respect others who get good grades	19	39	35	10	
Students seek extra work so they can get good grades	38	45	15	5	
Teachers believe their students can achieve	1	20	59	23	
Academic achievement is acknowledged by the school	2	50	47	34	
Students try hard to improve on previous work	27	52	20	4	
<u>The learning environment is orderly and serious</u>	9	41	42	11	

Note. N = 103. RO = Rarely Occurs, SO = Sometimes Occurs, OO = Often Occurs, VFO = Very Frequently Occurs

For calculation purposes, the “Often Occurs” percentages and the “Very Frequently Occurs” percentages were collapsed. Ninety-eight percent of the participants think that the students in their school can regularly achieve their predetermined goals. For item (b), 79.6% believe that their schools set high academic standards. The data line up with the data from item (f); 78.6% of the respondents claim that their institutions recognize academic achievements. As far as peer respect among students, 81.6% say that it happens regularly. In terms of students

seeking additional work, 80.6% of the participants say it happens sometimes. This correlates with the data from item (g), which asks teachers to rate how often students try hard to improve their grades. Of the teachers, 73.8% say that it sometimes happens. For the final item, 91.3% of the participants say that their learning environment is regularly orderly and serious.

Is there a relationship between science teacher retention and school climate?

A Pearson correlation was used to answer Research Question One. The null hypothesis states that there is no relationship between science teacher retention and school climate. Each subscale was correlated with the dependent variable using the Pearson statistic. Table 5.10 is a summary of the OHI-S correlation data.

Table 5.10

OHI-S Correlation Table

Subscale	Mean	SD	Pearson r	
			r	p
			<u>Retention</u>	
Institutional Integrity	2.68	0.63	0.08	0.42
Initiating Structure	3.25	0.46	-0.18	0.06
Consideration	2.69	0.45	-0.67	0.63
Principal Influence	2.73	0.55	-0.19	0.02*
Resource Support	2.65	0.32	0.00	0.97
Morale	2.84	0.69	-0.10	0.30
Academic Emphasis	2.65	0.68	-0.13	0.19

Note. N = 103.

*p < .05.

One subscale within the OHI-S returned significant results. Principal influence ($r = -0.19$, $N = 103$, $p = 0.02$) is a Likert-scale item that references a principal's level of autonomy in regards to her or his superiors. The correlation is small and negative, and the effect is small. Based on these results, the null hypothesis could theoretically be rejected and the alternative hypothesis supported. There is a statistical relationship between a science teacher's years of experience and school health, specifically as it relates to the principal's influence on the school.

The next section analyzes the data for science teacher efficacy.

Science Teacher Retention and Teacher Efficacy

Summary of STEBI data.

The Science Teacher Efficacy Belief Instrument (STEBI) has two subscales, Personal Teacher Efficacy (PTE) and Outcome Expectancy (OE). Each subscale is scored on a 5-point Likert-scale. The Personal Teacher Efficacy subscale refers to a science teacher's supervisory style, defined in terms of task-oriented and person-oriented behavior. The cluster has 13 items.

- I am continually finding better ways to teach science.
- Even when I try very hard, I do not teach science as well as I do most subjects.
- I know the steps necessary to teach science concepts effectively.
- I am not very effective in monitoring science experiments.
- I generally teach science ineffectively.
- I understand science concepts well enough to be effective in teaching current science courses.
- I find it difficult to explain to students why science experiments work.
- I am typically able to answer students' science questions.
- I wonder if I have the necessary skills to teach science.
- Given a choice, I would not invite the principal to evaluate my science teaching.
- When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.
- When teaching science, I usually welcome student questions.
- I do not know what to do to turn students on to science.

The Personal Teacher Efficacy subscale has both positively-worded and negatively-worded items designed to assess a teacher's level of confident in science teaching. Table 5.11 lists the frequencies and the percentages from the Personal Teacher Efficacy subscale.

Table 5.11

Frequencies for Personal Teacher Efficacy

Efficacy Attributes	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Personal Teacher Efficacy					
1. Better Ways	49(48)	47(46)	3(3)	4(4)	0(0)
2. Cannot Teach Science	1(1)	3(3)	2(2)	29(28)	68(66)
3. Science Concepts	35(34)	31(30)	2(2)	14(14)	21(20)
4. Monitoring Experiments	3(3)	5(5)	6(6)	38(37)	51(50)
5. Ineffective Teaching	0(0)	7(7)	0(0)	25(24)	71(69)
6. Effective Teaching	45(44)	22(21)	0(0)	9(9)	27(26)
7. Science Experiments	2(2)	4(4)	2(2)	36(35)	59(57)
8. Answer Questions	45(44)	26(25)	1(1)	10(10)	21(20)
9. Necessary Skills	2(2)	2(2)	5(5)	29(28)	65(63)
10. No Evaluation	41(40)	3(3)	6(6)	13(13)	21(20)
11. Difficulty Understanding	3(3)	3(3)	3(3)	33(32)	61(59)
12. Welcome Questions	75(73)	24(23)	1(1)	3(3)	0(0)
13. Turn Students On	24(23)	33(32)	19(18)	12(12)	15(15)

Note. N= 103. Percentages are in parentheses and may not total 100% due to rounding.

Items 1, 3, 6, 8, and 12 are positively-worded statements, and 77.5% of the participants chose “Strongly Agree” or “Agree” as their response, indicating that they are very confident in their ability to teach science. Items 2, 4, 5, 7, 9, 10, 11 and 13 are negatively-worded statements. For items 2, 4, 5, 7, 9 and 11, 91.4% of the participants chose “Strongly Disagree” or “Disagree” as their response, further validating their certainty in their science teaching. However, for item 10, 61.2% of the participants said they would not invite the principal to evaluate their science teaching if they were given a choice. For item 13, 55.3% of the respondents agree that they do not know what to do to turn students on to science.

The Outcome Expectancy subscale refers to a science teacher's expectancy of student performance in regards to her or his role in it. With this cluster, the items regard teaching effort as it relates to student performance. There are 12 items in this cluster.

- When a student does better than usual in science, it is often because the teacher exerted little extra effort.
- When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.
- If students are underachieving in science, it is most likely due to ineffective science teaching.
- The inadequacy of a student's science background can be overcome by good teaching.
- The low science achievement of some students cannot generally be blamed on their teachers.
- When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher.
- Increased effort in science teaching produces little change in some students' science achievement.
- The teacher is generally responsible for the achievement of students in science.
- Students' achievement in science is directly related to their teacher's effectiveness in science teaching.
- If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.

- Effectiveness in science teaching has little influence on the achievement of students with low motivation.
- Even teachers with good science teaching abilities cannot help some kids to learn science.

The Outcome Expectancy subscale has both positively-worded and negatively-worded items designed to assess a teacher's level of confidence in science teaching. Table 5.12 lists the frequencies and the percentages from the Outcome Expectancy subscale.

Table 5.12

Frequencies for Outcome Expectancy

Efficacy Attributes	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Outcome Efficacy					
1. Exerting Effort	3(3)	35(34)	33(32)	26(25)	6(6)
2. Teaching Approach	11(11)	52(50)	30(29)	9(9)	1(1)
3. Underachievement	1(1)	10(10)	28(27)	47(46)	17(17)
4. Inadequacy	10(10)	50(49)	10(10)	22(21)	11(11)
5. Teacher Blame	17(17)	49(48)	24(23)	12(12)	1(1)
6. Extra Attention	6(6)	46(45)	19(18)	25(24)	7(7)
7. Increased Effort	5(5)	38(37)	15(15)	33(32)	12(12)
8. Student Performance	12(12)	27(26)	23(22)	38(37)	3(3)
9. Teacher Effectiveness	8(8)	28(27)	24(23)	42(41)	1(1)
10. Teacher Performance	14(14)	64(62)	17(17)	7(7)	1(1)
11. Low Motivation	9(9)	40(39)	16(16)	27(26)	11(11)
12. Inability to Help	9(9)	29(28)	17(17)	37(36)	11(11)

Note. N= 103. Percentages are in parentheses and may not total 100% due to rounding.

Items 1, 2, 3, 4, 6, 8, 9 and 10 are positively-worded statements. Item 1 had some variability in the responses: 37% selected either “Strongly Agree” or “Agree,” 32% selected “Undecided,” and 31% selected “Strongly Disagree” or “Disagree.” For items 2 and 10, 61.2% and 75.7% of the respondents reported either “Strongly Agree” or “Agree,” respectively. Items 2 and 10 are performance-based items, indicating that student improvement in science is a result of

their teacher's performance. The large percentage of positive responses further confirms the participants' confidence in their teaching abilities. This is supported by the results of item 3, where 62.1% of the respondents chose "Strongly Disagree" or "Disagree." It is also further supported by items 4 and 6. For these items, 58.2%, and 50.5% of the participants chose "Strongly Agree" or "Agree" as their response, respectively. Items 8 and 9 had some variability; item 8 had 37.9% of the respondents select either "Strongly Agree" or "Agree" and 39.8% select "Strongly Disagree" or "Disagree." Item 9 had 35% of the participants select either "Strongly Agree" or "Agree" and 41.8% of the participants select either "Strongly Disagree" or "Disagree."

Items 5, 7, 11 and 12 are negatively-worded statements that relate student motivation to teacher performance. With these items, there was some variability in the responses. Item 5 had 64.1% of the respondents reporting either "Strongly Agree" or "Agree," and 23.3% "Undecided." Item 7 had 43% of participants reporting either "Strongly Disagree" or "Disagree," and 41.8% reporting either "Strongly Agree" or "Agree." Item 11 had 47.5% of the respondents reporting either "Strongly Agree" or "Agree," and 36.9% reporting either "Strongly Disagree" or "Disagree." Item 12 had 36.9% of the respondents reporting either "Strongly Agree" or "Agree," and 46.6% reporting either "Strongly Disagree" or "Disagree."

Is there a relationship between science teacher retention and teacher efficacy?

A Spearman rho was used to answer Research Question Two. The null hypothesis is that there is no relationship between science teacher retention and science teacher efficacy. Each subscale of the STEBI was correlated with the dependent variable. Table 5.13 is a summary of the data.

Table 5.13

STEBI Correlation Table

Subscale	Mean	SD	Spearman rho	
			r_s	p
Personal Teaching Efficacy	3.56	1.53	0.34	0.74
Outcome Expectancy	2.88	1.02	0.20	0.04*

Note. N = 103.

*p < .05

For the Personal Teaching Efficacy subscale ($r_s = 0.34$, N = 103, p = 0.74), the results are not statistically significant. But for the Outcome Expectancy subscale ($r_s = 0.20$, N = 103, p = .04), the results are statistically significant. Therefore, the null hypothesis of no relationship is rejected. There is a statistical relationship between teacher efficacy and science teacher retention in urban schools. The relationship is small and positive, but it does exist.

The next section covers the analysis of the TAS data.

Science Teacher Retention and Professional Development

Summary of TAS data.

The Teacher Activity Survey (TAS) has seven subscales and is scored using either a dichotomous key or a 5-point Likert-scale. Each cluster has between one and 12 individual items. The TAS is concerned with the amount of science professional development a teacher has engaged in and its effects on their teaching practices. The five dichotomous key questions are specific instances of professional development activities, and the two Likert-scale questions are reflective statements.

Clusters one and two: Professional development participation.

The Science Teacher Professional Development subscale asks the question, “In the past school year (2010-2011), did you participate in any of the following types of professional

development related to your science teaching?” There are 11 items, and each item denotes a particular kind of professional development activity a science teacher may have engaged in.

- Within-district workshops or institutes.
- Courses for college credit.
- Out-of-district workshops and institutes.
- Teacher collaboratives or networks.
- Out-of-district conferences.
- Immersion or internship activities.
- Receiving mentoring, coaching, lead teaching, or observation.
- Teacher resource center.
- Committees or task forces.
- Teacher study groups.
- Other forms of organized professional development related to science teaching.

The Individual Professional Development subscale asks the question, “In the past school year (2010-2011), did you participate in any of the following types of individual professional development related to your science teaching?” The selections are (a) Individual research project, (b) Individual learning, (c) Attending a state or regional conference, and (d) Attending a national or international conference. Figure 5.1 illustrates the cluster frequencies.

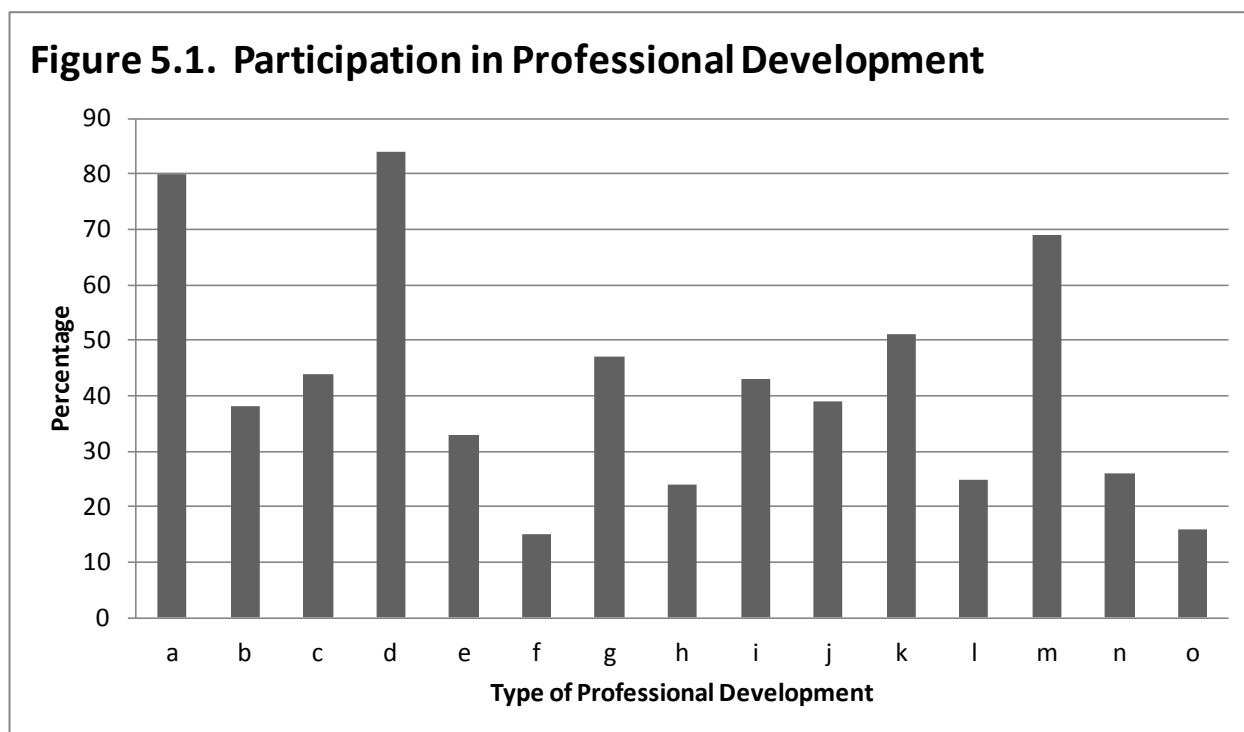


Figure 5.1. Participant responses to the PDP clusters. Items: (a) Within-district workshops or institutes, (b) Courses for college credit, (c) Out-of-district workshops and institutes, (d) Teacher collaboratives or networks, (e) Out-of-district conferences, (f) Immersion or internship activities, (g) One-on-one mentoring/coaching, (h) Teacher resource center, (i) Committees or task forces, (j) Teacher study groups, (k) Other forms of organized professional development related to science teaching, (l) Individual research project, (m) Individual learning, (n) Attending a state or regional conference, and (o) Attending a national or international conference.

As expected, 80% and 84% of the participants engaged in mandated professional development such as within-district workshops and professional learning communities, respectively. Sixty-nine percent of the participants engaged in individual learning to supplement their professional development, and 51% engaged in other forms of professional development related to science teaching.

The majority of the participants in this sample (68.9%) have between five and 15 years experience, and 31.1% have at least 16 years experience. Figure 5.2 shows how the professional development participation differs between these two groups of teachers.

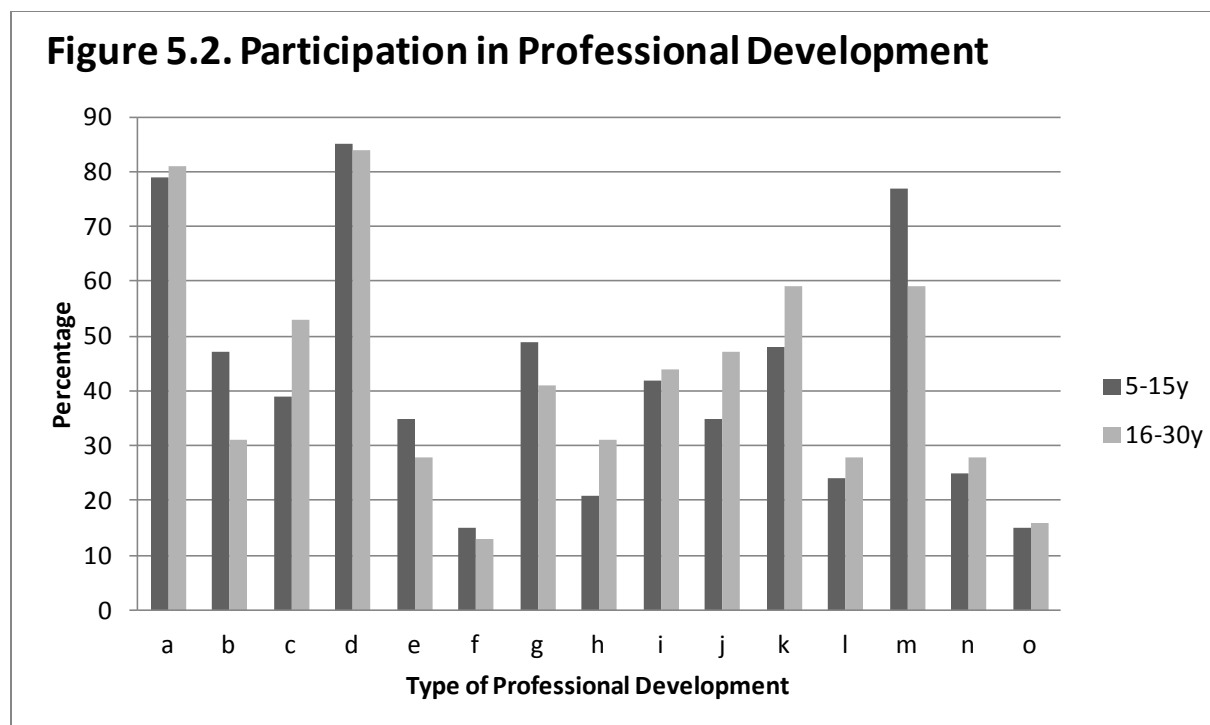


Figure 5.2. Experience group participant responses to the PDP clusters. Items: (a) Within-district workshops or institutes, (b) Courses for college credit, (c) Out-of-district workshops and institutes, (d) Teacher collaboratives or networks, (e) Out-of-district conferences, (f) Immersion or internship activities, (g) One-on-one mentoring/coaching, (h) Teacher resource center, (i) Committees or task forces, (j) Teacher study groups, (k) Other forms of organized professional development related to science teaching, (l) Individual research project, (m) Individual learning, (n) Attending a state or regional conference, and (o) Attending a national or international conference.

As expected, the involvement in professional development is mostly even between the two groups, but 53% of teachers with at least 16 years' experience participated more in out of district workshops, 47% participated in study groups, and 59% took part in other forms of professional development. Comparing this data to the teachers with up to 15 years of experience yields 39%, 48%, and 59%, respectively. Conversely, 47% of teachers with less than 16 years' experience took applicable college courses, 49% engaged in some form of mentoring and/or coaching, and 77% took part in individual learning. Comparing this data to the teachers with 16+ years of experience yields 31%, 41% and 59%, respectively.

Clusters three and five: Implementation.

Cluster Three on the TAS asks the question, “Have you attempted to adjust your teaching practices because of your participation in professional development activities?” Participants were asked to choose either “Yes” or “No.” The fifth cluster deals with the implementation of professional development in the science classroom. It asks the question, “Did any of the following issues arise in your efforts to introduce changes in your teaching based on your experience in professional development activities?” There are nine item choices.

- Insufficient planning time.
- Inadequate classroom materials.
- Resistance from other teachers.
- Resistance from administrators.
- Resistance from parents.
- Class sizes too large to implement.
- Conflict between changes and needs.
- Conflict between changes and state.
- Insufficient opportunity to practice.

The implementation issues in Cluster Five centered on applying information garnered through professional development opportunities to different aspects of classroom practice.

Figure 5.3 illustrates the cluster frequencies.

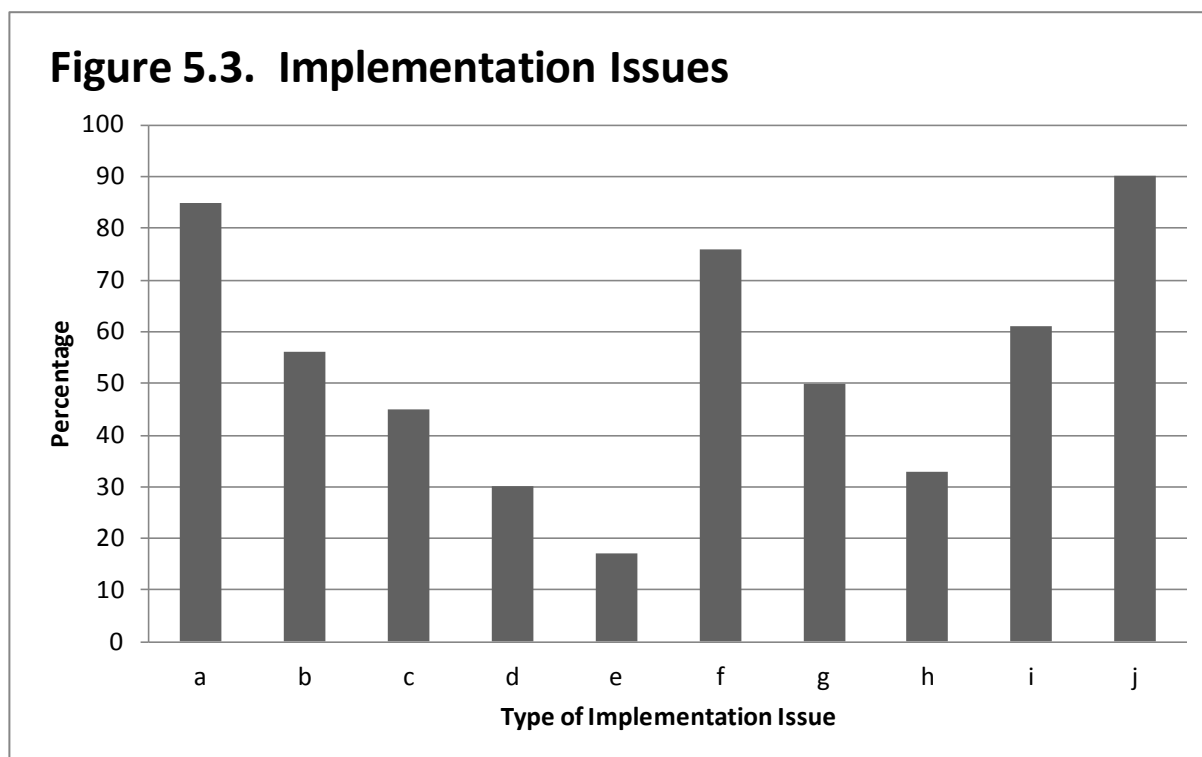


Figure 5.3. Participant responses to the Implementation clusters. Items: (a) Insufficient planning time, (b) Inadequate classroom materials, (c) Resistance from other teachers, (d) Resistance from administrators, (e) Resistance from parents, (f) Class sizes too large to implement, (g) Conflict between changes and needs, (h) Conflict between changes and state, (i) Insufficient opportunity to practice, (j) “Have you attempted to adjust your teaching practices because of your participation in professional development activities?”

For item (j), which asks the question “Have you attempted to adjust your teaching practices because of your participation in professional development activities,” 90% of the respondents reported yes. Items (a) through (i) address the types of issues that took place. In regards to implementing ideas gained from professional development, results show that 85% of the participants claim that they had insufficient planning, 76% claim they had classes too large to implement the ideas, and 61% said they had insufficient opportunity to practice. Figure 5.4 shows how the data breaks down between the two experience groups.

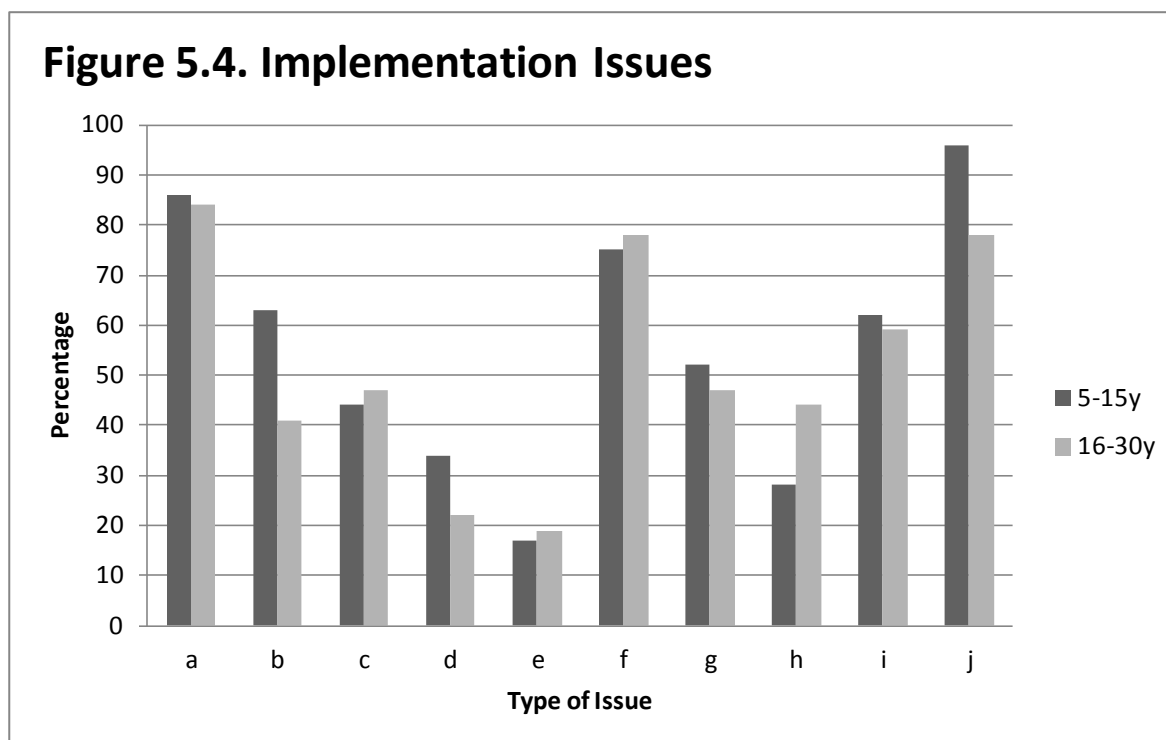


Figure 5.4. Experience group participant response to the Implementation clusters. Items: (a) Insufficient planning time, (b) Inadequate classroom materials, (c) Resistance from other teachers, (d) Resistance from administrators, (e) Resistance from parents, (f) Class sizes too large to implement, (g) Conflict between changes and needs, (h) Conflict between changes and state, (i) Insufficient opportunity to practice, (j) “Have you attempted to adjust your teaching practices because of your participation in professional development activities?”

Comparing the five to 15-year group to the 16-30-year group produces the following:

96% of the lesser experienced teachers attempted to adjust their teaching practices versus 78% for the more experienced teachers. In regards to the implementation issues, there is very little difference between the groups, with the exception of items (b), (d) and (h). Sixty-three percent of teachers with up to 15 years’ experience said they had inadequate resources compared to 41% of the more experienced teachers. In regards to item (d), 34% of teachers with up to 15 years experience felt they had more resistance from administrators compared to 22% of teachers with more than 15 years’ experience. In regards to item (h), 44% of more experienced teachers claim they had trouble implementing ideas due to the conflicts between the changes they wanted to make and state requirements, compared to 28% of teachers with 15 years experience or less.

Cluster four: Knowledge, skills and abilities.

The Knowledge, Skills & Abilities subscale on the TAS asks the participant to rate the following statement on a 5-point Likert scale, “I think my knowledge and skills have been enhanced in each of the following areas as a result of my participation in professional development activities.” There are 12 item choices.

- Curriculum.
- Instructional methods.
- Approaches to assessments.
- Use of technology in instruction.
- Developing strategies for ESL students.
- Developing strategies for students of other cultures.
- Deepening knowledge of science.
- Leadership development.
- Adapting teaching to meet state assessment requirements.
- Adapting teaching to meet state standards or curriculum framework requirements.
- Learning about state assessments in professional development.
- Learning about state standards or curriculum frameworks in professional development.

For the most part, 69.8% of the participants agreed that most of their knowledge, skills and abilities in their teaching practices were enhanced through professional development activities. Table 5.14 breaks down the 12 items.

Table 5.14

Knowledge & Skill Enhancement in Teaching Practices

Teaching Practice	Percentage of Teachers Agreed
Curriculum	69.7%
Instructional methods	88.6%
Approaches to assessments	77.9%
Use of technology in instruction	69.7%
Developing strategies for ESL students	35.1%
Developing strategies for students of other cultures	31.0%
Deepening knowledge of science	58.9%
Leadership development	49.0%
Adapting teaching to meet state assessment requirements	84.6%
Adapting teaching to meet state standards	84.0%
Learning about state assessments in professional development	67.4%
Learning about state standards or curriculum frameworks	78.7%

Note. N = 103.

Cluster six: Teaching practices.

Cluster Six asks the question, “In which of the following areas did you make changes in your teaching practices as a result of your participation in professional development activities?”

There are 6 item choices: (a) Science curriculum content, (b) Cognitive challenge of science classroom activities, (c) Instructional methods I employ, (d) Types or mix of assessments I use to evaluate students, (e) Ways I use technology in instruction, and (f) The approaches I take to student diversity. Figure 5.12 shows the cluster frequencies.

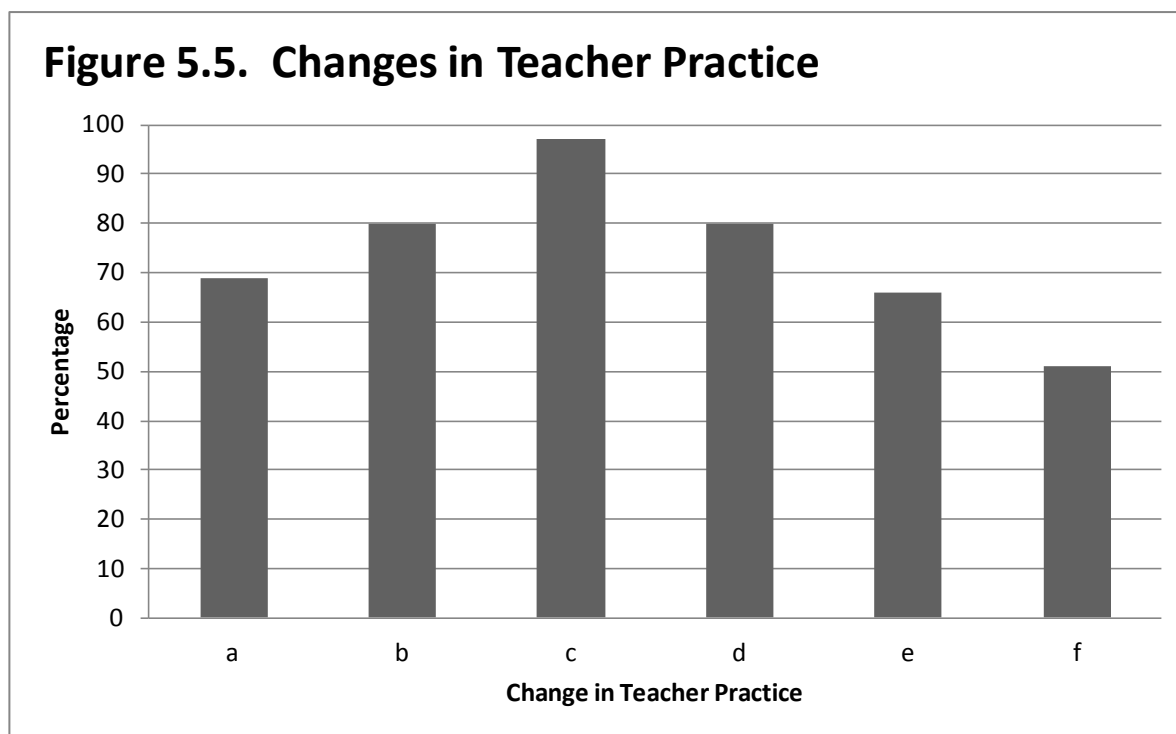


Figure 5.5. Participant responses to the Teacher Practice cluster. Items: (a) Science curriculum content, (b) Cognitive challenge of science classroom activities, (c) Instructional methods I employ, (d) Types or mix of assessments I use to evaluate students, (e) Ways I use technology in instruction, and (f) The approaches I take to student diversity.

In regards to changing teacher practices, 69% and 97% of the respondents claimed they altered their science curriculum and instruction as a result of their participation in professional development, respectively. In regards to the content, 80% of the participants made their content more challenging, and 80% mixed it up. To accommodate student diversity, 51% improved their procedures. Figure 5.6 shows the experience group frequencies.

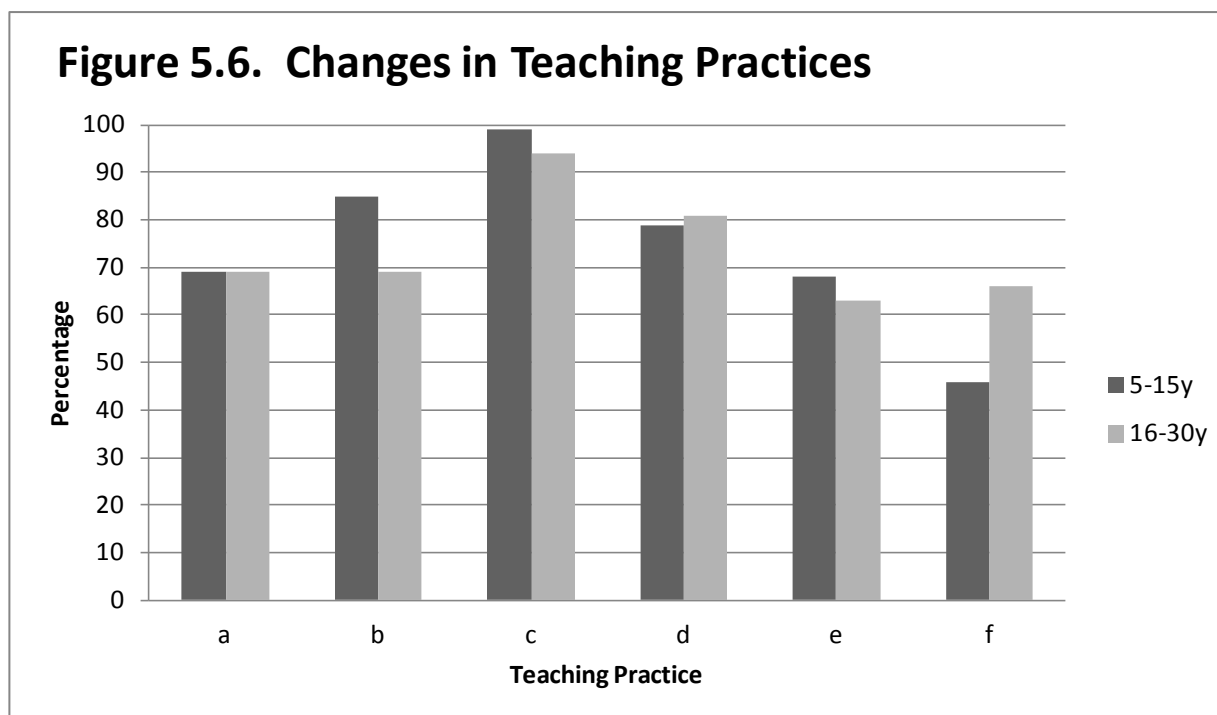


Figure 5.6. Experience group participant response to the Teacher Practice cluster. Items: (a) Science curriculum content, (b) Cognitive challenge of science classroom activities, (c) Instructional methods I employ, (d) Types or mix of assessments I use to evaluate students, (e) Ways I use technology in instruction, and (f) The approaches I take to student diversity.

When the data were grouped by years of experience, there was hardly any difference. For item (b), 80% of the teachers with up to 15 years of experience made their lessons more challenging, compared to 69% of the more experienced group. For item (f), 66% of the more experienced teachers made changes in their practices related to student diversity compared to 46% of lesser experienced teachers.

Cluster seven: Student learning and engagement.

The final subscale, Student Learning and Engagement, asks participants to rate the following statement, “I think that student learning and engagement have improved in the following areas as a result of my participation in professional development activities.” There are eight item choices.

- Ability to memorize facts, definitions or formulas.

- Conceptual understanding.
- Ability to perform science procedures.
- Ability to generate hypotheses.
- Ability to collect, analyze and interpret data.
- Ability to use information to make connections.
- Positive attitudes regarding science.
- Rate of attendance.

For most of the items in this cluster, a majority of the participants agreed that participation in professional development enhanced their practice enough to affect student learning and engagement. Table 5.15 breaks down the eight items.

Table 5.15

<i>Student Ability Enhancement</i>	
<u>Student Ability</u>	<u>Percentage of Teachers Agreed</u>
Ability to memorize facts, definitions or formulas	27.4%
Conceptual understanding	79.0%
Ability to perform science procedures	61.6%
Ability to generate hypotheses	53.6%
Ability to collect, analyze and interpret data	59.3%
Ability to use information to make connections	73.9%
Positive attitudes regarding science	65.3%
Rate of attendance	27.1%

Note. N = 103.

Is there a statistical relationship between science teacher retention and professional development?

A Spearman rho was used to answer this question. The null hypothesis is that there is no relationship between science teacher retention and professional development. Each of the seven subscales of the Teacher Activity Survey (TAS) was correlated with the dependent variable using the Spearman rho correlation. Table 5.16 is a summary of the data.

Table 5.16

TAS Correlation Table

Subscale	Mean	SD	Spearman rho	
			r_s	p
			<u>Retention</u>	
Science Teaching	1.55	0.44	0.03	0.79
Knowledge, Skills & Abilities	2.29	0.72	-0.02	0.83
Issues in Teaching	1.49	0.42	-0.03	0.76
Student Learning & Engagement	2.61	0.66	-0.13	0.20
Changes in Teaching Practice	1.26	0.32	0.06	0.55
Individual Learning	1.66	1.88	0.10	0.30
Adjusting Teaching Practice	1.09	0.28	0.26	0.01*

Note. N = 103.

*p < .05

For all but one of the TAS subscales, the results are not statistically significant. The subscale Adjusting Teacher Practice ($r_s = 0.26$, $N = 103$, $p = .01$), the results are statistically significant. Therefore, the null hypothesis of no relationship is rejected. There is a statistical relationship between teacher efficacy and science teacher retention in urban schools. The relationship is small and positive, but it does exist.

What are the best predictors among school climate, teacher efficacy, and professional development to science teacher retention in urban schools?

The only regression method that generated any results to answer this question was the backwards technique. With backwards regression analysis, an assessment of the pooled effect of all the independent variables on the dependent variable is performed. From here, independent variables are removed, starting with the weakest IV, and a new analysis is performed until a stable model is produced. Using the backwards regression method, it was determined that organizational health and science teacher efficacy combined to produce the following model:

$$\hat{y} = 0.920 - 0.008x_1 + 0.024x_2$$

The adjusted R^2 is 0.031. This means that 3.1% of the variance is explained by organizational health and science teacher efficacy. Professional development has no impact on science teacher retention in urban schools.

The next section covers gender differences in the data.

Gender Differences

Are there gender differences in the perceptions of science teachers in regards to school climate, science teacher efficacy and professional development?

An independent samples T-test was used to compare STRFI component scores between females and males to see if there were gender differences. Table 5.17 is a summary of the T-test data.

Table 5.17

Comparison of Means

Instrument	Females		Males	
	Mean	SD	Mean	SD
OHI-S	2.78	0.58	2.79	0.61
STEBI	3.25	1.32	3.16	1.35
TAS	1.71	0.48	1.70	0.47

Note. N = 103.

For the OHI-S, there was not a significant difference between females and males with conditions $t(101) = -0.06$, $p > 0.05$. For the STEBI, there was not a significant difference between females and males with conditions $t(101) = 1.75$, $p > 0.05$. For the TAS, there was not a significant difference between females and males with conditions $t(101) = 0.41$, $p > 0.05$. Any differences are due to chance.

A chi square statistic is used to investigate whether distributions of categorical variables differ from one another. In this instance, the researcher wanted to see if individual subscale

scores differ between females and males. The null hypothesis is that there are no differences in individual subscale scores. Table 5.18 is a summary of the chi square results.

Table 5.18

Pearson Chi Square Correlations

OHI-S	
Institutional Integrity	$X^2(20, N = 103) = 24.3, p = 0.23$
Initiating Structure	$X^2(10, N = 103) = 8.36, p = 0.59$
Consideration	$X^2(15, N = 103) = 5.92, p = 0.98$
Principal Influence	$X^2(13, N = 103) = 15.6, p = 0.27$
Resource Support	$X^2(15, N = 103) = 12.7, p = 0.63$
Morale	$X^2(20, N = 103) = 33.1, p = 0.33$
Academic Emphasis	$X^2(20, N = 103) = 16.3, p = 0.70$
STEBI	
Personal Teaching Efficacy	$X^2(17, N = 103) = 14.6, p = 0.62$
Outcome Efficacy	$X^2(19, N = 103) = 29.0, p = 0.07$
TAS	
Science Teaching Professional Development	$X^2(10, N = 103) = 6.56, p = 0.77$
Knowledge, Skills & Abilities	$X^2(25, N = 103) = 22.7, p = 0.59$
Implementation Issues	$X^2(9, N = 103) = 10.5, p = 0.31$
Student Learning & Engagement	$X^2(27, N = 103) = 21.0, p = 0.78$
Changes in Teaching Practice	$X^2(27, N = 103) = 2.31, p = 0.89$
Individual Professional Development	$X^2(4, N = 103) = 0.50, p = 0.97$
Adjusting Teaching Practice	$X^2(1, N = 103) = 0.00, p = 0.97$

Note. N = 103.

For the chi square tests, none of the scores were statistically significant. Accordingly, there are no significant differences between male and female participants, so the null hypothesis of no difference could not be rejected.

Examining the data on a more detailed level yielded specific results. Teachers were divided by gender and then subdivided by years of experience. In terms of school climate, Tables 5.19 and 5.20 illustrate the differences in the means for the seven individual OHI-S subscales based on years of experience.

Table 5.19

Comparison of Means for the OHI-S Based on Five to 15 Years of Experience

	<u>Females</u>		<u>Males</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
5 years				
Institutional Integrity	2.22	0.54	3.21	0.56
Initiating Structure	3.17	0.54	3.60	0.22
Consideration	2.54	0.33	3.60	0.55
Principal Influence	2.57	0.28	3.30	0.50
Resource Support	2.23	0.41	3.50	0.00
Morale	2.47	0.64	3.78	0.44
Academic Emphasis	2.68	0.66	3.50	0.76
6 – 10 years				
Institutional Integrity	2.89	0.38	2.46	0.73
Initiating Structure	3.21	0.54	3.28	0.54
Consideration	2.57	0.35	2.50	0.50
Principal Influence	2.73	0.47	2.62	0.54
Resource Support	2.77	0.26	2.90	0.40
Morale	2.84	0.48	2.78	0.88
Academic Emphasis	2.57	0.59	2.64	0.81
11 – 15 years				
Institutional Integrity	2.69	0.36	2.77	0.59
Initiating Structure	3.32	0.44	3.02	0.59
Consideration	2.77	0.43	2.25	0.67
Principal Influence	2.74	0.33	2.80	0.65
Resource Support	2.40	0.28	2.35	0.33
Morale	2.95	0.47	2.55	0.83
Academic Emphasis	2.64	0.60	2.51	0.60

Note. N = 103.

Table 5.20

Comparison of Means for the OHI-S Based on 16 – 30+ Years of Experience

	<u>Females</u>		<u>Males</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
16 – 20 years				
Institutional Integrity	2.71	0.37	2.19	0.94
Initiating Structure	3.34	0.30	3.50	0.00
Consideration	2.62	0.41	4.00	0.00
Principal Influence	2.68	0.44	3.30	0.50
Resource Support	2.73	0.24	3.50	0.35
Morale	2.81	0.49	3.00	0.92
Academic Emphasis	2.68	0.55	2.11	0.82
21 – 25 years				
Institutional Integrity	2.69	0.55	2.77	0.70
Initiating Structure	3.32	0.68	3.02	0.59
Consideration	2.77	0.58	2.25	0.47
Principal Influence	2.74	0.61	2.80	0.70
Resource Support	2.40	0.24	2.35	0.38
Morale	2.95	0.49	2.55	0.73
Academic Emphasis	2.64	0.55	2.51	0.90
26 – 30 years				
Institutional Integrity	2.43	0.86	2.64	0.53
Initiating Structure	3.70	0.27	3.00	0.64
Consideration	4.00	0.00	2.70	0.50
Principal Influence	2.00	0.35	3.10	0.55
Resource Support	2.70	0.50	3.30	0.50
Morale	3.00	0.67	2.90	0.60
Academic Emphasis	2.89	0.58	2.56	0.65
30+ years				
Institutional Integrity	2.57	0.61	2.43	0.53
Initiating Structure	3.20	0.50	2.60	0.55
Consideration	2.90	0.22	2.40	1.14
Principal Influence	2.70	0.69	2.20	1.10
Resource Support	3.00	0.45	1.80	0.45
Morale	3.20	0.61	3.10	0.87
Academic Emphasis	2.67	1.19	2.44	1.06

Note. N = 103.

An independent samples T-test was used to analyze the OHI-S data. There was a significant difference between female and male teachers with five years' experience (N = 9). For these science teachers, males (M = 3.50, SD = 0.43) reported high scores than their female counterparts (M = 2.55, SD = 0.49) with conditions $t(12) = -6.67, p = 0.00$. There was also a significant difference between female and male teachers with 30+ years' experience (N = 3). For these science teachers, females (M = 2.89, SD = 0.61) reported high scores than their male counterparts (M = 2.42, SD = 0.81) with conditions $t(12) = 2.64, p = 0.02$. High scores on the OHI-S are indicative of schools with healthy climates. Males with five years' experience reported that their schools had healthier climates than their female counterparts, and females with 30+ years' experience reported that their schools had healthier climates than their male counterparts. None of the other experience categories reported noteworthy differences between males and females.

In terms of science teacher efficacy, Table 5.14 illustrates the differences in the means for the two individual STEBI subscales based on years of experience.

Table 5.21

Comparison of Means for the STEBI

	<u>Females</u>		<u>Males</u>	
	<u>Mean</u>	<u>SD</u>	<u>Mean</u>	<u>SD</u>
5 years				
Personal Teacher Efficacy	3.42	1.35	3.46	1.40
Outcome Expectancy	2.77	0.79	3.12	0.87
6 – 10 years				
Personal Teacher Efficacy	3.62	1.38	3.45	1.70
Outcome Expectancy	2.94	0.61	2.74	1.16
11 – 15 years				
Personal Teacher Efficacy	3.65	1.39	3.49	1.49

Outcome Expectancy	2.82	0.64	2.72	0.90
16 – 20 years				
Personal Teacher Efficacy	3.54	1.23	3.79	1.77
Outcome Expectancy	2.95	0.71	2.85	1.54
21 – 25 years				
Personal Teacher Efficacy	3.46	1.24	3.73	1.83
Outcome Expectancy	3.05	0.64	2.78	1.30
26 – 30 years				
Personal Teacher Efficacy	3.68	1.91	3.14	1.60
Outcome Expectancy	3.23	1.10	2.96	0.83
30+years				
Personal Teacher Efficacy	4.04	1.60	3.57	1.13
Outcome Expectancy	2.88	1.26	3.69	0.62

Note. N = 103.

As with the OHI data, a T-test was performed with the STEBI data. There were no significant differences between female and male subscale scores regardless of experience.

Like before, the TAS data were analyzed by cluster, and the cluster data were split into three experience groups as illustrated on the following figures. The groups are five and six to 10, 11 – 15 and 16 – 20, and 21 – 25, 26 – 30, and 30+. This was done for comparative purposes

Clusters one and two: Professional development participation.

Figure 5.7 shows the frequency data for clusters one and two, and the data are broken down by gender and years of experience; in this case zero to five and six to 10.

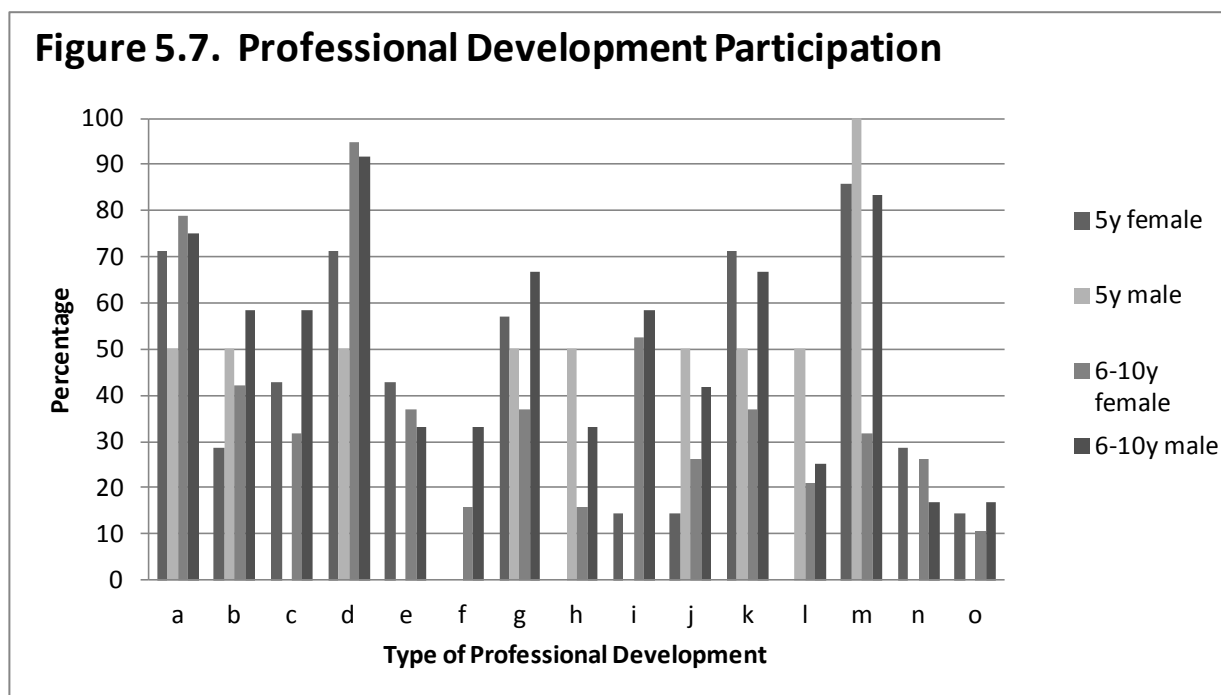


Figure 5.7. Participant responses to the PDP clusters. Items: (a) Within-district workshops or institutes, (b) Courses for college credit, (c) Out-of-district workshops and institutes, (d) Teacher collaboratives or networks, (e) Out-of-district conferences, (f) Immersion or internship activities, (g) One-on-one mentoring/coaching, (h) Teacher resource center, (i) Committees or task forces, (j) Teacher study groups, (k) Other forms of organized professional development related to science teaching, (l) Individual research project, (m) Individual learning, (n) Attending a state or regional conference, and (o) Attending a national or international conference.

For teachers with five years' experience teaching science, more females participated in a variety professional development activities than males with the exception of item (m).

According to the data, 100% of the male participants engaged in individual learning, compared to 86% of the females. However, for teachers with six to 10 years' experience, more males have participated in the listed forms of professional development than females with the exception of items (a), (d), (e) and (n). According to the data, 79% of the women have completed within-district workshops, 95% have participated in professional learning communities, 37% have attended out-of-district workshops, and 26% have attended either a state or regional conference. Comparing this data to the men yields 75%, 92%, 33%, and 17%, respectively.

Figure 5.8 shows the frequency data for years of experience 11 - 15 and 16 - 20.

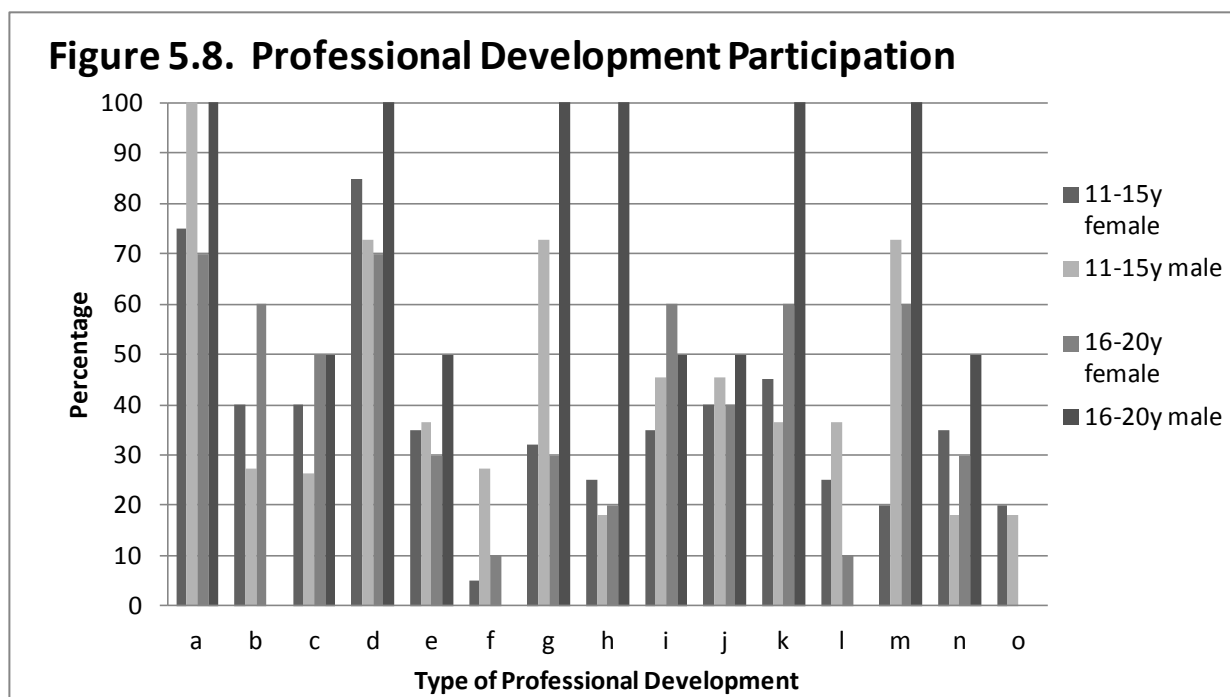


Figure 5.8. Participant responses to the PDP clusters. Items: (a) Within-district workshops or institutes, (b) Courses for college credit, (c) Out-of-district workshops and institutes, (d) Teacher collaboratives or networks, (e) Out-of-district conferences, (f) Immersion or internship activities, (g) One-on-one mentoring/coaching, (h) Teacher resource center, (i) Committees or task forces, (j) Teacher study groups, (k) Other forms of organized professional development related to science teaching, (l) Individual research project, (m) Individual learning, (n) Attending a state or regional conference, and (o) Attending a national or international conference.

More males with 11 – 15 years of experience participated in within-district workshops, one-on-one mentoring, committees, study groups, individual research, and individual learning. More females in this same experience range took college courses, attended out-of-district conferences, participated in professional learning communities, utilized a teacher resource center, participated in other forms of professional development, and attended a state or regional conference. In the case of teachers that have between 16 – 20 years' experience, more males than females have participated in the listed activities with the exception of items (b), (f), and (k), where 0% of the men participated. For item (o), there was no participation for either gender.

Figure 5.9 shows the frequency data for years of experience 21 – 25, 26 – 30, and 30+.

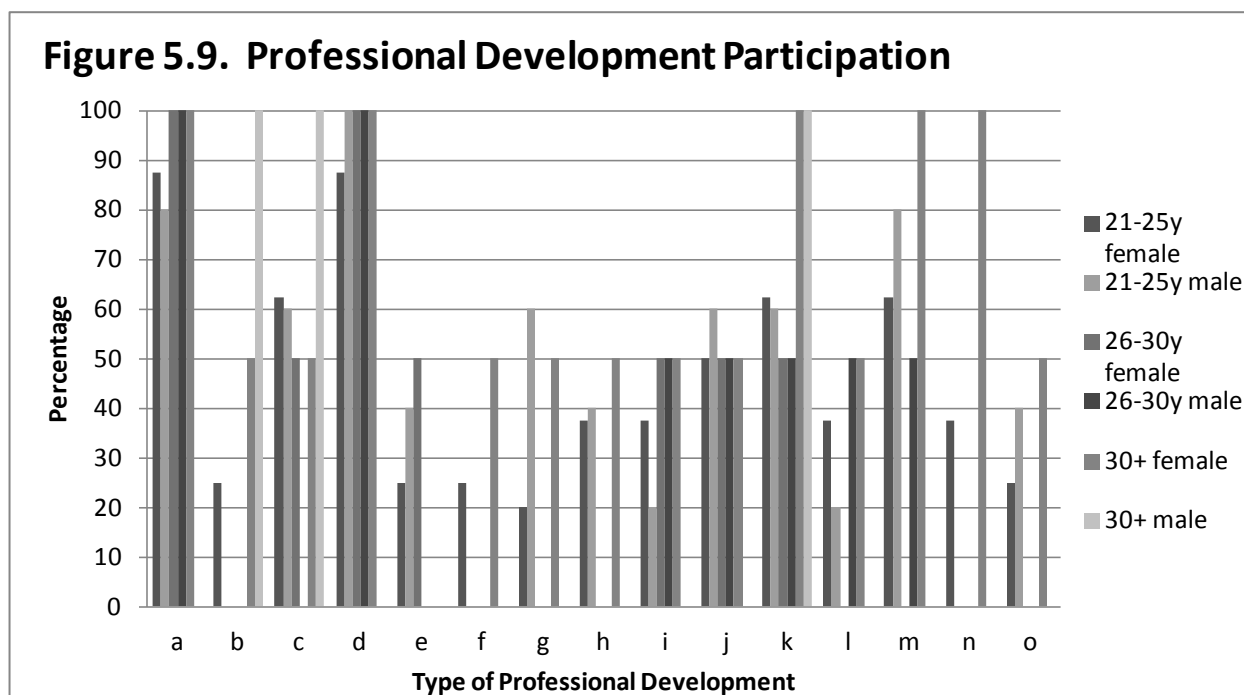


Figure 5.9. Participant responses to the PDP clusters. Items: (a) Within-district workshops or institutes, (b) Courses for college credit, (c) Out-of-district workshops and institutes, (d) Teacher collaboratives or networks, (e) Out-of-district conferences, (f) Immersion or internship activities, (g) One-on-one mentoring/coaching, (h) Teacher resource center, (i) Committees or task forces, (j) Teacher study groups, (k) Other forms of organized professional development related to science teaching, (l) Individual research project, (m) Individual learning, (n) Attending a state or regional conference, and (o) Attending a national or international conference.

For teachers with 21 – 25 years of experience, more females attended within-district workshops, were members of committees, participated in other forms of professional development, and completed individual research projects compared to the males. For teachers with 26 – 30 years and 30+ years in the science classroom, the professional development participation experiences were fairly even.

Clusters three and five: Implementation.

Figure 5.10 shows the frequency data for clusters three and five, and the data are broken down by gender and years of experience; in this case zero to five and six to 10.

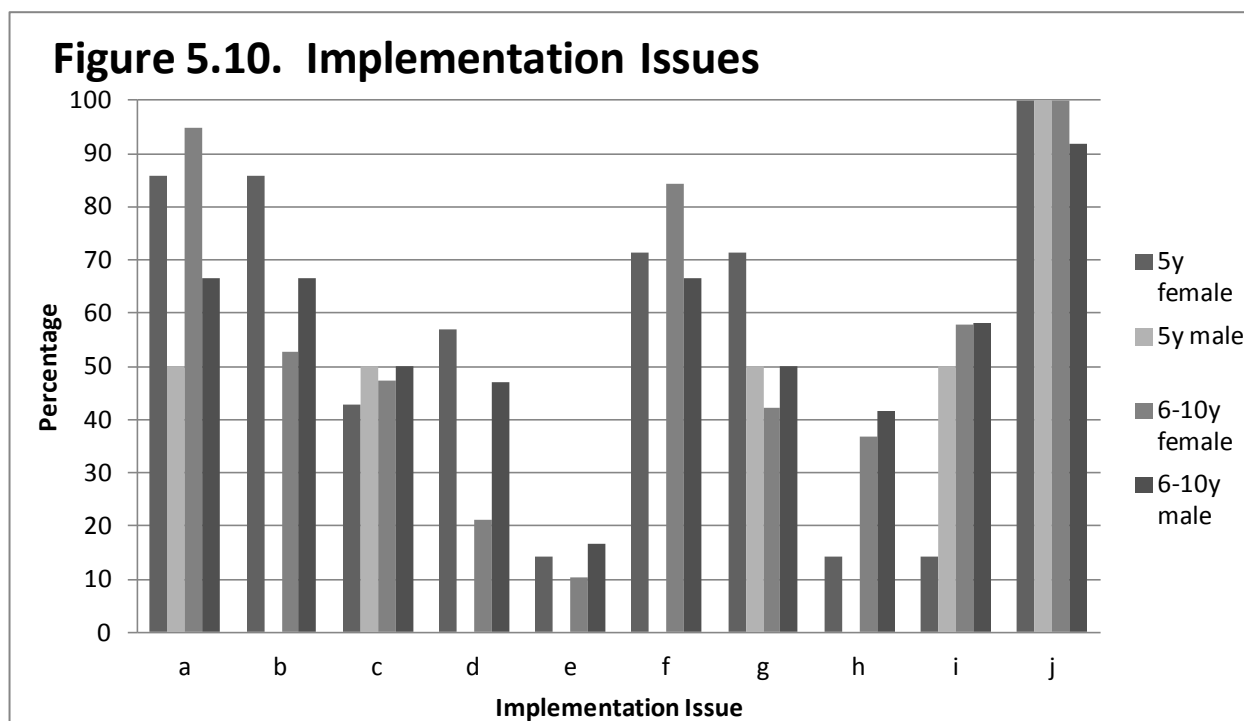


Figure 5.10. Participant response to the Implementation clusters. Items: (a) Insufficient planning time, (b) Inadequate classroom materials, (c) Resistance from other teachers, (d) Resistance from administrators, (e) Resistance from parents, (f) Class sizes too large to implement, (g) Conflict between changes and needs, (h) Conflict between changes and state, (i) Insufficient opportunity to practice, (j) “Have you attempted to adjust your teaching practices because of your participation in professional development activities?”

More female teachers with five years’ experience have experienced implementation issues than their male counterparts. The results for teachers with between six and 10 years in the classroom tend to be fairly even for both genders, with the exception of items (a) and (f). More women than men have cited insufficient planning time and large class sizes as barriers to implementing ideas gained from professional development.

Figure 5.11 shows the frequency data for years of experience 11 - 15 and 16 - 20.

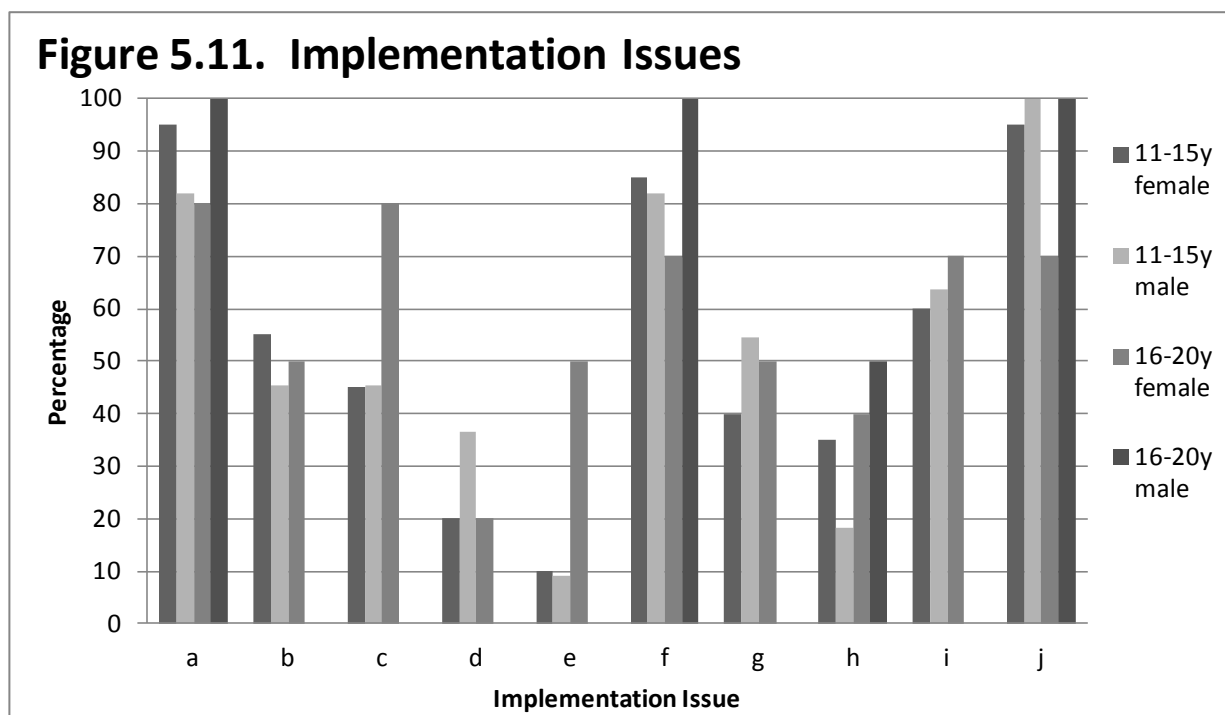


Figure 5.11. Participant response to the Implementation clusters. Items: (a) Insufficient planning time, (b) Inadequate classroom materials, (c) Resistance from other teachers, (d) Resistance from administrators, (e) Resistance from parents, (f) Class sizes too large to implement, (g) Conflict between changes and needs, (h) Conflict between changes and state, (i) Insufficient opportunity to practice, (j) “Have you attempted to adjust your teaching practices because of your participation in professional development activities?”

There is little variation in the results for teachers with up to 15 years’ experience. The percentages are high for items (a) and (f), with the women having a slightly greater edge than the men. Again, the issues in question are planning time and large classes. For teachers with 16 – 20 years, 100% of the male participants cited only (a) and (f) as their barriers to implementation, but there was more variation from the female participants.

Figure 5.12 shows the frequency data for years of experience 21 – 25, 26 – 30, and 30+.

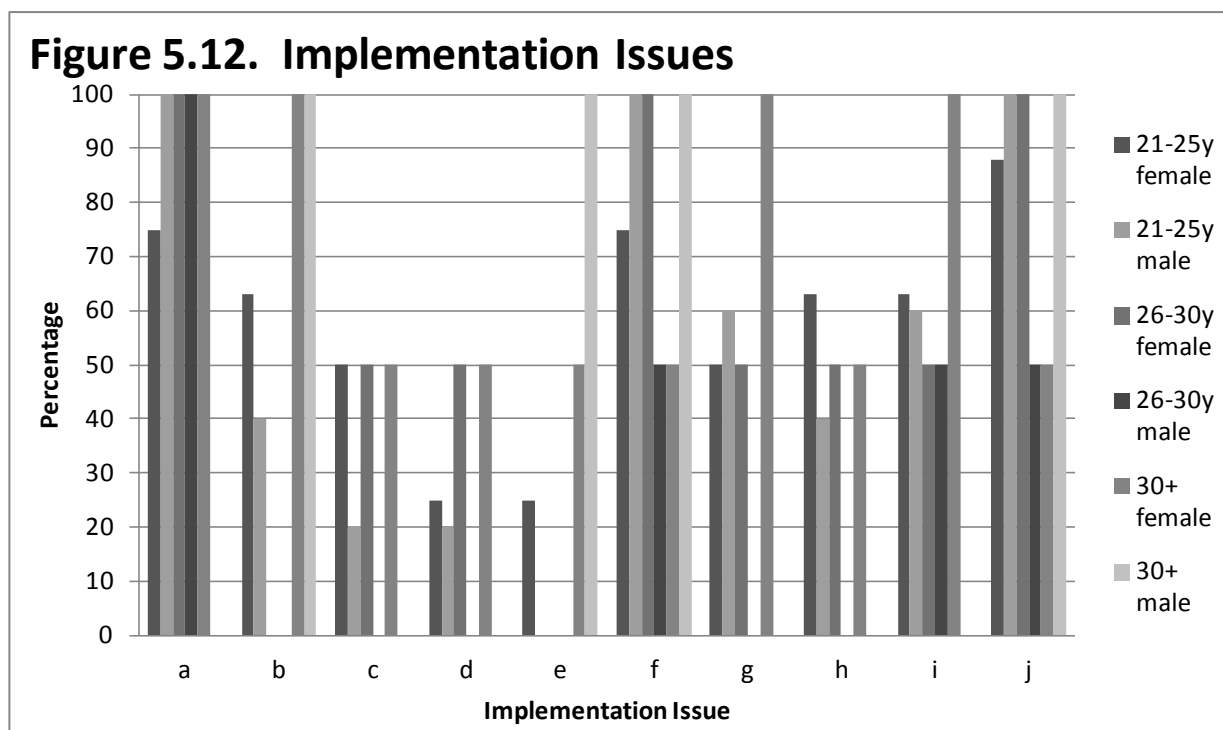


Figure 5.12. Participant response to the Implementation clusters. Items: (a) Insufficient planning time, (b) Inadequate classroom materials, (c) Resistance from other teachers, (d) Resistance from administrators, (e) Resistance from parents, (f) Class sizes too large to implement, (g) Conflict between changes and needs, (h) Conflict between changes and state, (i) Insufficient opportunity to practice, (j) “Have you attempted to adjust your teaching practices because of your participation in professional development activities?”

For teachers with 21 – 25 years, the same pattern as the results for teachers with 16 – 20 years. 100% of the male participants cited (a) and (f) as their main barriers to implementation, but there was more variation from the female participants. For teachers with 26 – 30 years and 30+ years in the science classroom, the barriers to implementing ideas gained from professional development were reasonably even between genders.

Cluster four: Knowledge and skills.

Figure 5.13 shows the frequency data for cluster four, and the data are broken down by gender and years of experience; in this case zero to five and six to 10.

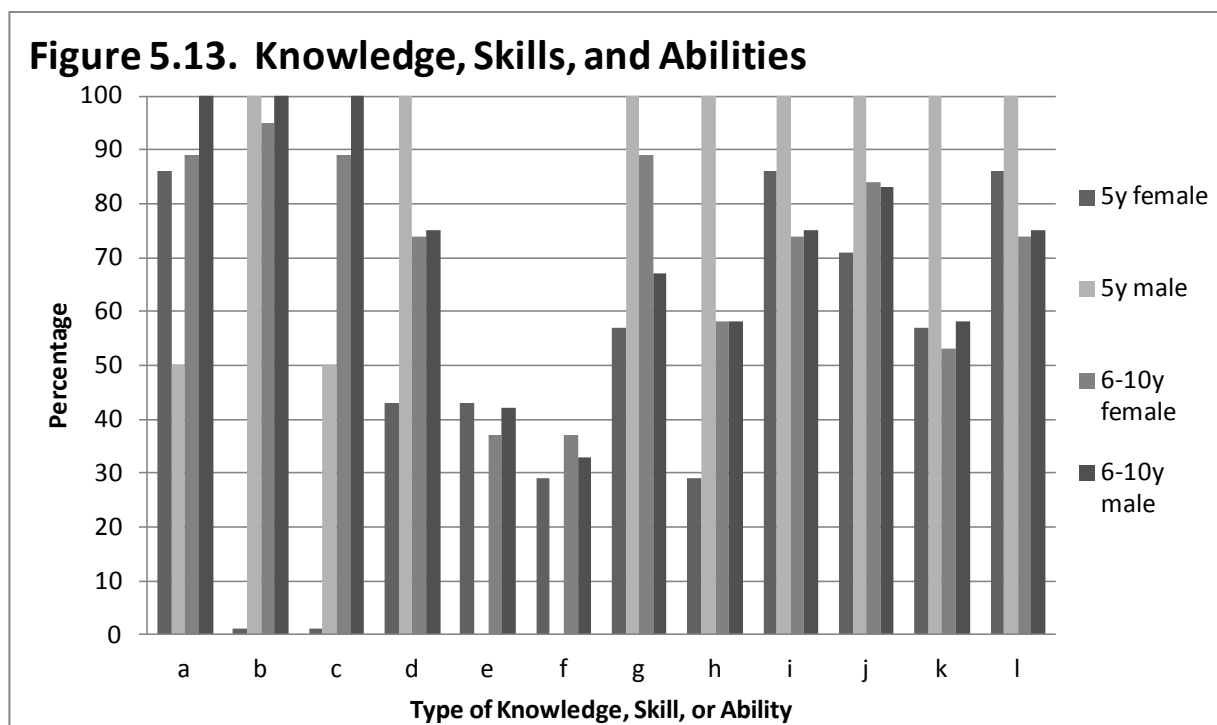


Figure 5.13. Participant response to Knowledge, Skills & Abilities cluster. Items: (a) Curriculum, (b) Instructional methods, (c) Approaches to assessments, (d) Use of technology in instruction, (e) Developing strategies for ESL students, (f) Developing strategies for students of other cultures, (g) Deepening knowledge of science, (h) Leadership development, (i) Adapting teaching to meet state assessment requirements, (j) Adapting teaching to meet state standards or curriculum framework requirements, (k) Learning about state assessments in professional development, (l) Learning about state standards or curriculum frameworks in professional development.

More male teachers than female teachers with five years' experience agree that their knowledge, skills and abilities increased as a result of their participation in professional development in each of the twelve categories with the exception of items (a), (e), and (f). More female novices cited an improvement in curricular knowledge, ESL and other cultural strategy development than the males. There is little variation in the results between males and females with six to 10 years in the classroom, with the exception of item (g). More women (89%) than men (67%) believe that their knowledge of science has increased because of professional development experience.

Figure 5.14 shows the frequency data for years of experience 11 - 15 and 16 - 20.

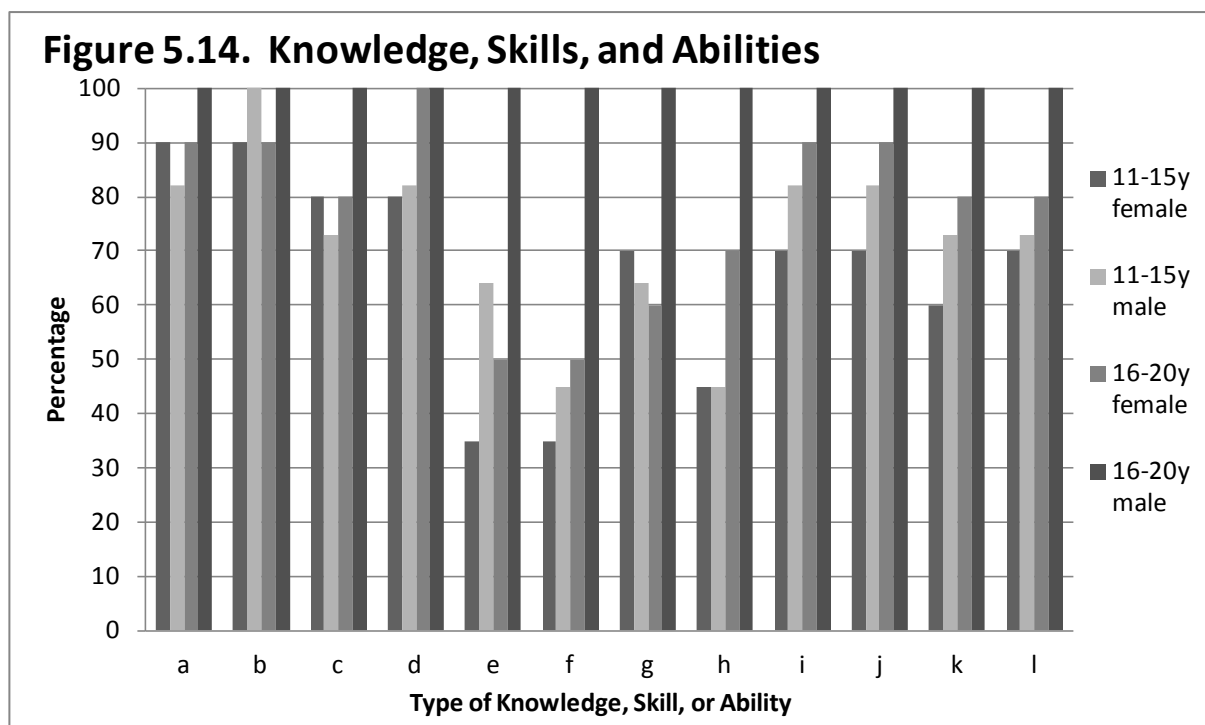


Figure 5.14. Participant response to Knowledge, Skills & Abilities cluster. Items: (a) Curriculum, (b) Instructional methods, (c) Approaches to assessments, (d) Use of technology in instruction, (e) Developing strategies for ESL students, (f) Developing strategies for students of other cultures, (g) Deepening knowledge of science, (h) Leadership development, (i) Adapting teaching to meet state assessment requirements, (j) Adapting teaching to meet state standards or curriculum framework requirements, (k) Learning about state assessments in professional development, (l) Learning about state standards or curriculum frameworks in professional development.

There is little variation in the results between males and females with 11 to 15 years in the classroom, with the exception of item (e). Sixty-four percent of male respondents believe that they have been better able to develop strategies for ESL students as a result of their participation in professional development compared to 35% of females. Examination of the 16 – 20 year data shows that 100% of the male respondents believe that their knowledge and skills have improved across the board because of their involvement in professional development. The data with the females show a great deal of variability.

Figure 5.15 shows the frequency data for years of experience 21 – 25, 26 – 30, and 30+.

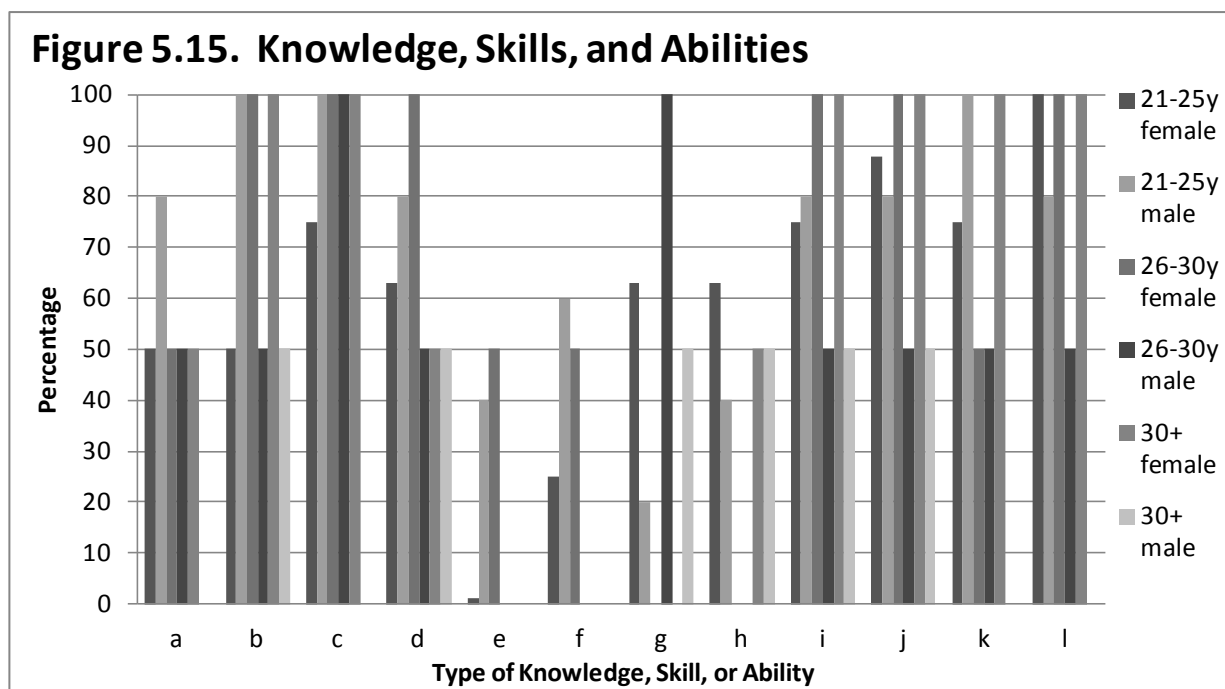


Figure 5.15. Participant response to Knowledge, Skills & Abilities cluster. Items: (a) Curriculum, (b) Instructional methods, (c) Approaches to assessments, (d) Use of technology in instruction, (e) Developing strategies for ESL students, (f) Developing strategies for students of other cultures, (g) Deepening knowledge of science, (h) Leadership development, (i) Adapting teaching to meet state assessment requirements, (j) Adapting teaching to meet state standards or curriculum framework requirements, (k) Learning about state assessments in professional development, (l) Learning about state standards or curriculum frameworks in professional development.

There is a great deal of variation in the results for teachers with 21 – 25 years of experience. Out of the 12 items, more females responded in regards to three of them, compared to seven for the males. More female teachers believe that they have improved in their knowledge of science, leadership, and state standards due to their involvement in professional development. More men believe that their curricular knowledge has improved, as well as their instructional and assessment methods, and their ability to develop strategies for ESL students and for students of other cultures. For teachers with 26 – 30 years and 30+ years in the science classroom, the results were reasonably even between genders.

Cluster six: Teaching Practices.

Figure 5.16 shows the frequency data for cluster six, and the data are broken down by gender and years of experience; in this case zero to five and six to 10.

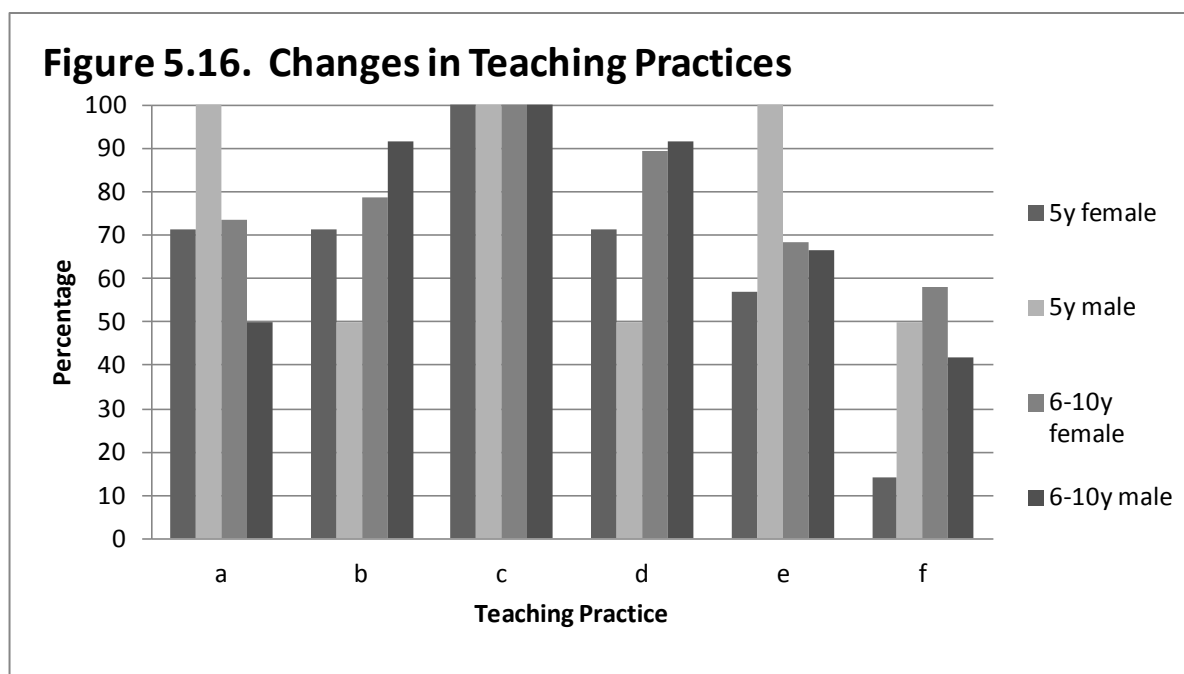


Figure 5.16. Participant response to the Teacher Practice cluster. Items: (a) Science curriculum content, (b) Cognitive challenge of science classroom activities, (c) Instructional methods I employ, (d) Types or mix of assessments I use to evaluate students, (e) Ways I use technology in instruction, and (f) The approaches I take to student diversity.

For teachers with five years' experience, more males adjusted their science curriculum, technology usage, and approaches to student diversity than their female counterparts. More females made their lessons harder and had more variety in their activities. For teachers with six to 10 years in the science classroom, more females adjusted their science curriculum and approaches to student diversity than their male counterparts. All of the teachers in these two groups made changes to the instructional methods they use in their classrooms.

Figure 5.17 shows the frequency data for cluster six for science teaching experience groups 11 – 15 and 16 - 20 years.

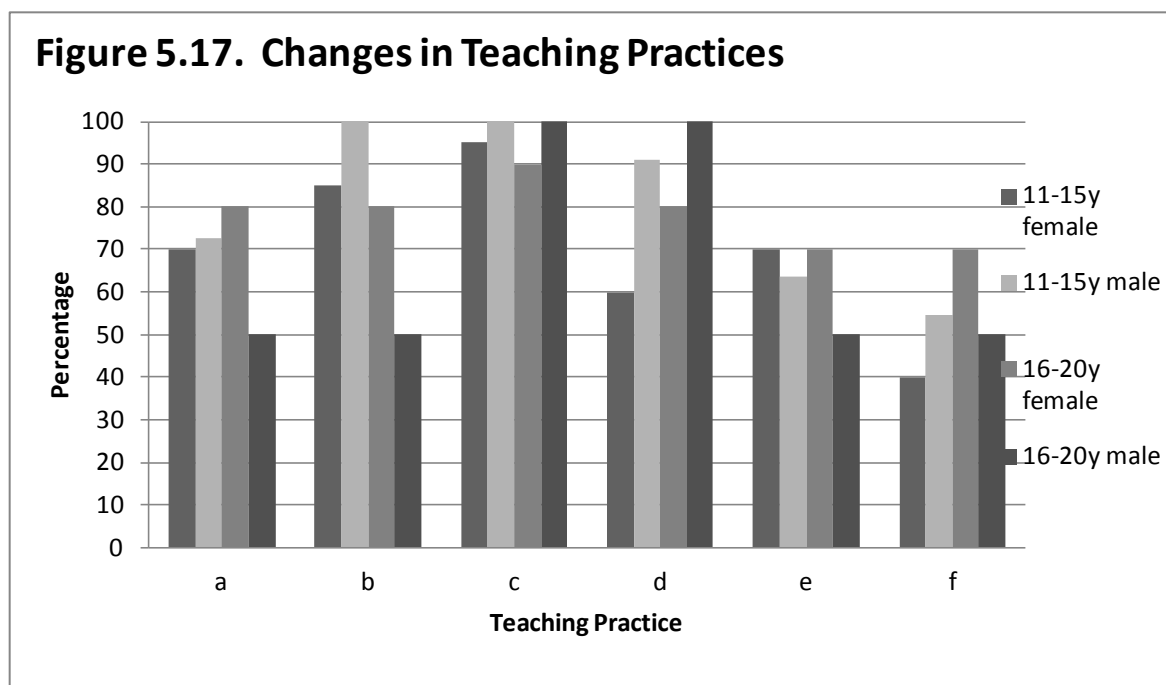


Figure 5.17. Participant response to the Teacher Practice cluster. Items: (a) Science curriculum content, (b) Cognitive challenge of science classroom activities, (c) Instructional methods I employ, (d) Types or mix of assessments I use to evaluate students, (e) Ways I use technology in instruction, and (f) The approaches I take to student diversity.

There is some variation here; male teachers with 11 - 15 years experience have changed their teaching practices more than the female teachers in that same group. The response rates are nearly similar in terms of instructional practices, but for all of the other items with the exception of (e), more men made adjustments than women. For science teachers with 16 - 20 years experience, more females changed their teaching practices as a result of professional development than males with the exception of items (c) and (d).

Figure 5.18 shows the frequency data for cluster six for science teaching experience groups 21 – 25, 26 - 30, and 30+ years.

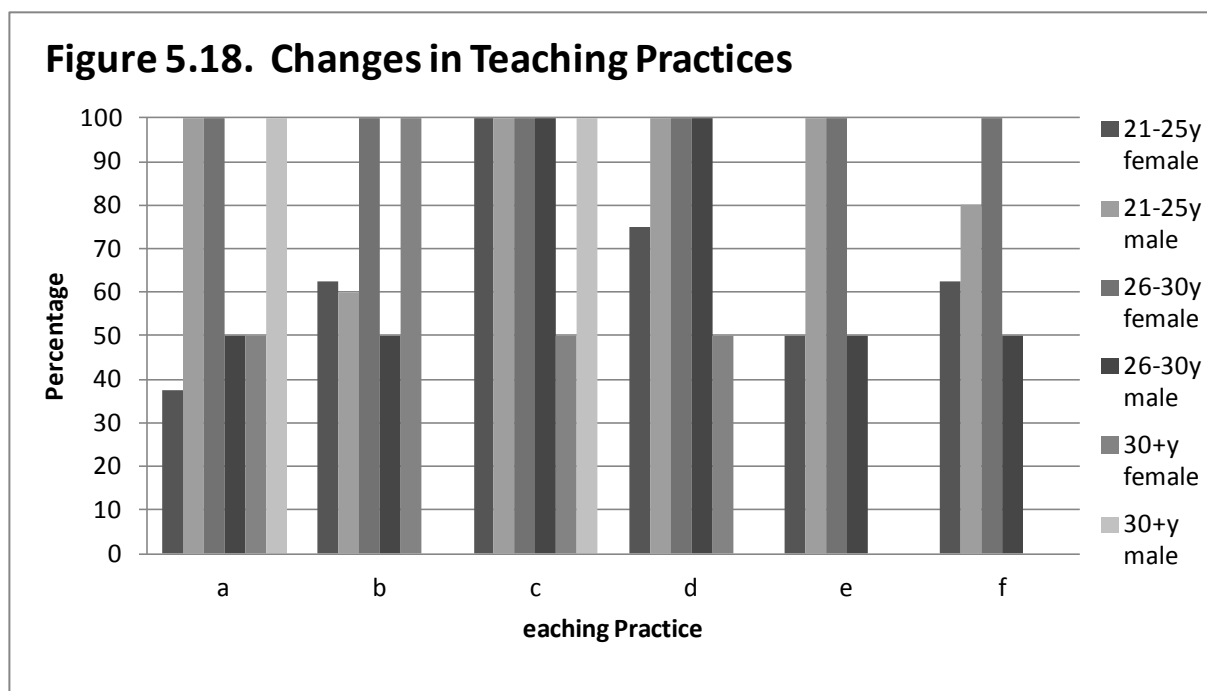


Figure 5.18. Participant response to the Teacher Practice cluster. Items: (a) Science curriculum content, (b) Cognitive challenge of science classroom activities, (c) Instructional methods I employ, (d) Types or mix of assessments I use to evaluate students, (e) Ways I use technology in instruction, and (f) The approaches I take to student diversity.

More male teachers with 21 – 25 years’ experience changed their teaching practices than their female counterparts. More female teachers between 26 – 30 years changed their teaching practices than their male counterparts, and at 30 years and up, the results were fairly even between genders.

Cluster seven: Student learning and engagement.

Figure 5.19 shows the frequency data for cluster seven, and the data are broken down by gender and years of experience; in this case zero to five and six to 10.

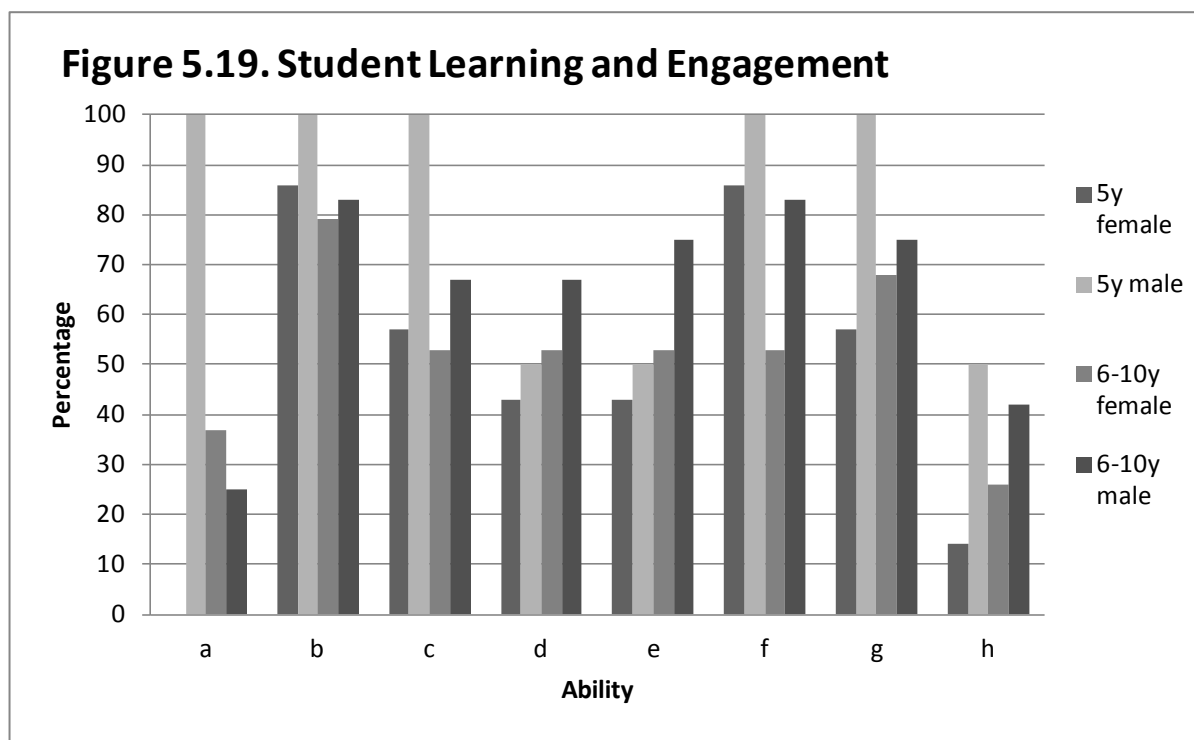


Figure 5.19. Participant response to Student Learning & Engagement cluster. Items (a) Ability to memorize facts, definitions or formulas, (b) Conceptual understanding, (c) Ability to perform science procedures, (d) Ability to generate hypotheses, (e) Ability to collect, analyze and interpret data, (f) Ability to use information to make connections, (g) Positive attitudes regarding science, (h) Rate of attendance.

For teachers with up to five years in the science classroom, more males than females believe that their students' learning and engagement have improved across the board as a result of their participation in professional development. With the exception of item (a), the same trend holds true for teachers with six to 10 years' experience.

Figure 5.20 shows the frequency data for cluster six for science teaching experience groups 11 – 15 and 16 - 20 years.

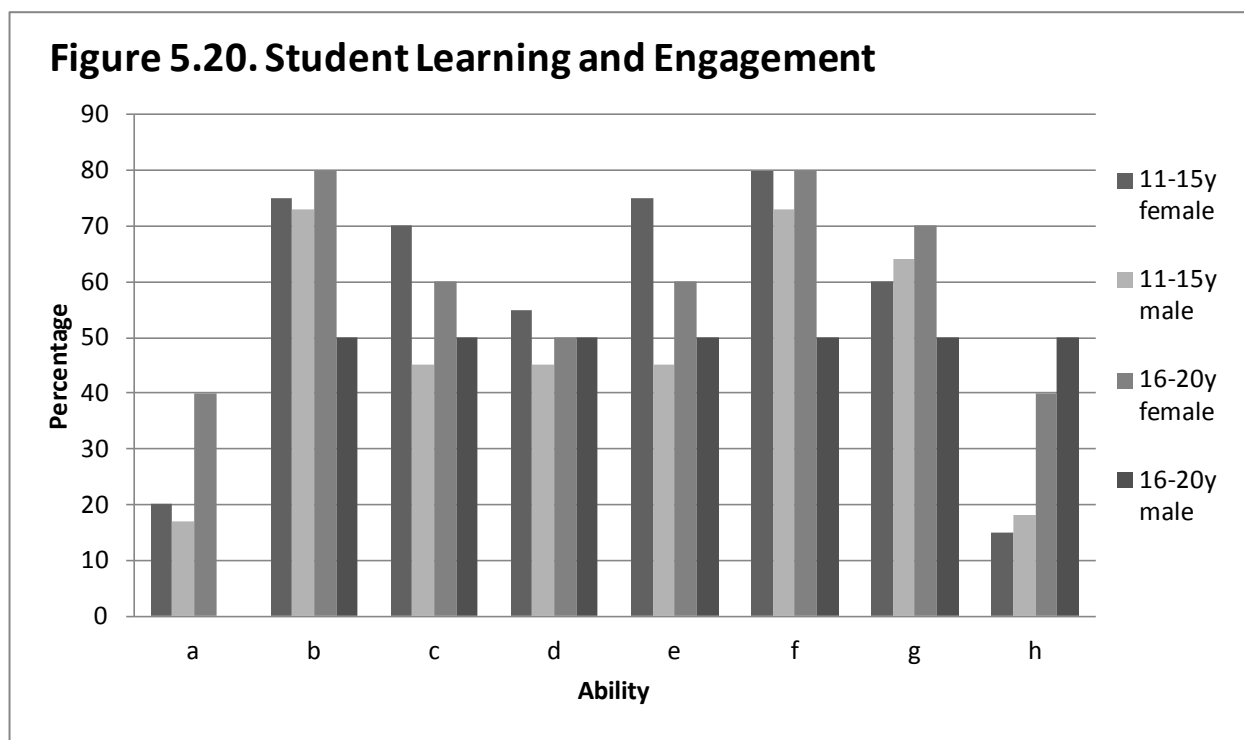


Figure 5.20. Participant response to Student Learning & Engagement cluster. Items (a) Ability to memorize facts, definitions or formulas, (b) Conceptual understanding, (c) Ability to perform science procedures, (d) Ability to generate hypotheses, (e) Ability to collect, analyze and interpret data, (f) Ability to use information to make connections, (g) Positive attitudes regarding science, (h) Rate of attendance.

More female teachers than male teachers with up to 15 years' experience agree that their student learning and engagement increased as a result of their participation in professional development in each of the eight categories with the exception of items (g) and (h). The same trend holds true for teachers with between 16 and 20 years of experience.

Figure 5.21 shows the frequency data for cluster six for science teaching experience groups 21 – 25, 26 – 30, and 30+ years.

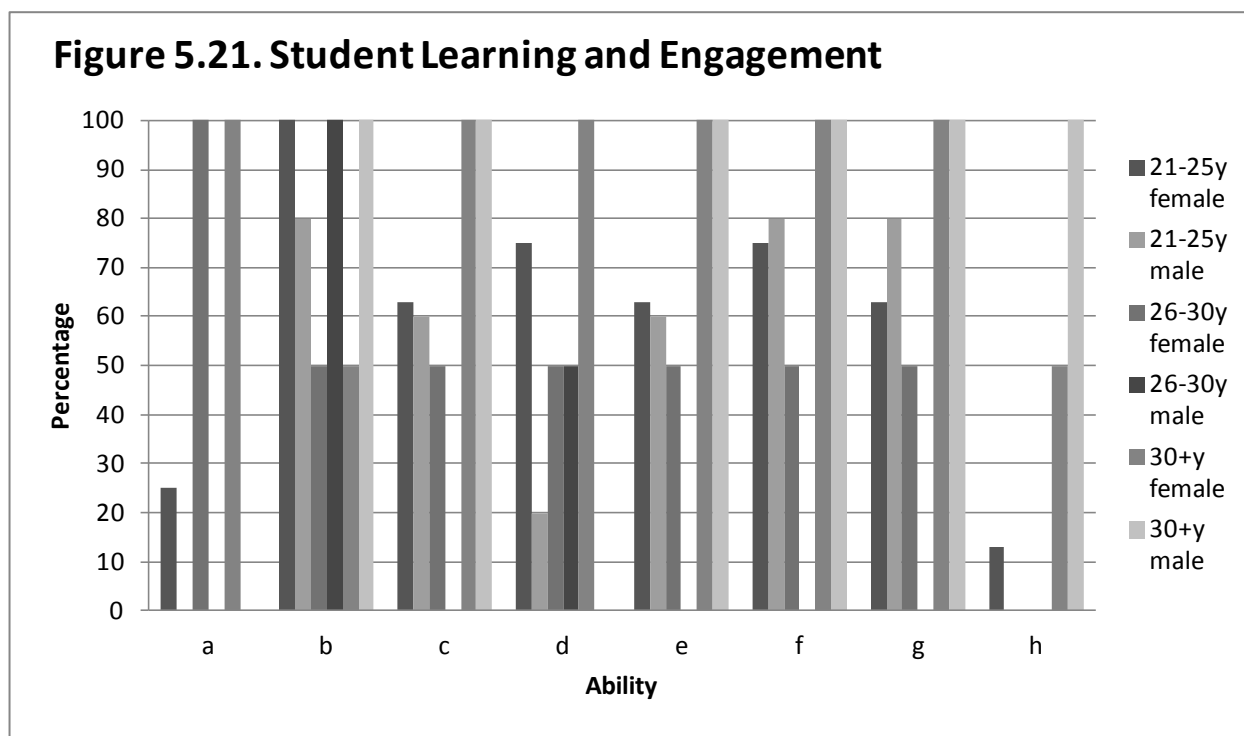


Figure 5.21. Participant response to Student Learning & Engagement cluster. Items (a) Ability to memorize facts, definitions or formulas, (b) Conceptual understanding, (c) Ability to perform science procedures, (d) Ability to generate hypotheses, (e) Ability to collect, analyze and interpret data, (f) Ability to use information to make connections, (g) Positive attitudes regarding science, (h) Rate of attendance.

More female teachers than male teachers with up to 25 years' experience agree that their student learning and engagement increased as a result of their participation in professional development in six of the eight categories. The exception occurs in items (f) and (g), where the male teachers have a slight edge. More female teachers than male teachers with between 26 – 30 years' experience agree that their students' learning and engagement increased, with the exception being item (c). However, for teachers with 30+ years' experience, there is little variation in the results; 100% believe that their students' engagement and learning increased as a result of professional development.

Free-Response Questions

There were three free-response questions in the STRFI. The questions were designed for participants to evaluate the effectiveness of the instrument delivery through Survey Monkey.

What did you like about completing this questionnaire using Survey Monkey?

Most of the respondents liked the fact that the questionnaire was easy to complete. They appreciated the convenience of completing the survey without any time constraints, and some liked the fact that it did not take long to finish. Three respondents said that the structure of the STRFI gave them time to reflect on their teaching practices, and one wrote that “questions were related to real issues that occur in science.”

What did you not like about completing this questionnaire using Survey Monkey?

Most of the respondents did not have any complaints about the questionnaire. But there were some who would have preferred to have an “Undecided” or “Not Applicable” option. Some thought that the lists for each subscale were too long, and others thought that the questions were vague and needed clarification. One person specifically stated, “Too many questions and most focused on training and placing the "blame" on teachers. Parenting from all backgrounds and income levels is the real issue and until this is stressed nationally, all subject areas in school will continue on the current trend downward.”

Do you have any suggestions for improving this questionnaire?

Most of the respondents had no suggestions for improvement. Out of the participants who elected to give an answer, the main suggestions were to include an “undecided” or “not applicable” option, and include a comments section for each subscale to clarify answers. One person specifically said that a “depends” option was necessary for some questions. Two respondents provided very specific answers. One wrote, “Give more thought to WHY a teacher may answer a certain way. Some of my answers were based on students simply being lazy when I think the question was intended to focus on student ability.” Another wrote, “At no time did you ask any questions about why I would remain at or leave a school, when the survey was

clearly about teacher retention. At no time did you ask how long I have taught at this school, how long I plan to continue to teach at this school, or if I plan on leaving and why. These are important questions that need to be addressed.”

If this study were to be repeated, the STRFI would be revised to include a comments section for each component, and provide an explanation for certain questions in the demographic section. To address the aforementioned question, the item “How many years have you taught in your current urban school?” was designed to measure retention. However, participants had no real way of knowing that, so a brief explanation would have been beneficial. More specific questions addressing participants’ future plans regarding their employment should be included, as it would provide some useful insight and foundations for future research. Considering the goals for the current study, the researcher believes that the STRFI adequately measured what it was intended to measure.

Summary

Chapter Five analyzed the data from the Science Teacher Retention Factors Instrument. The chapter was divided into three parts: descriptive statistics about the participants, inferential statistics that answered the research questions and free-response items that addressed the structure and delivery of the STRFI. It was determined that the Organizational Health Inventory and the Science Teacher Efficacy Belief Instrument produced statistically significant results. The Teacher Activity Survey did not produce significant outcomes. When the regression model was generated, it was determined that the Principal Influence subscale of the OHI-S combined with the Outcome Expectancy subscale of the STEBI had more predictive power than any of the other subscales. The chapter ended with a brief analysis of the free-response questions. The next chapter of this study will discuss the findings and conclude the dissertation.

CHAPTER SIX: CONCLUSIONS, DISCUSSION & RECOMMENDATIONS

Overview

Chapter Six of this dissertation will review the purpose of the investigation, discuss the results of the data analysis, answer the research questions, and attempt to draw reasonable conclusions and propose practical recommendations for school administration and future research. This chapter begins with a review of the study and highlights key aspects of the literature. Then conclusions are drawn from the data and discussed. Recommendations for principals, superintendents and future research are provided, and then the chapter ends with a summary of its contents.

Review of the Study

It is healthy for schools to have some turnover because turnover allows ineffective teachers to leave and new teachers with fresh ideas to enter, which helps the organization thrive. Retirement is inevitable and can be considered an essential component of a school's staffing plan. However, the untimely attrition cannot be accounted for and creates an unpredictable distraction and problems for schools. This disruption can cause the school system to incur financial, instructional, and organizational costs that can have an adverse effect on student achievement. Since student learning and achievement are the ultimate goals of schools, it is imperative for school officials to minimize premature turnover in order to keep the financial, instructional, and organizational costs in balance.

There are many factors that impact science teacher retention. This study focused on three of them: school climate, teacher efficacy and professional development. Research indicated that a healthy school climate; a workplace where science teachers have support, adequate resources, autonomy and participation in the decision-making process, are factors that foster retention (Amrein-Beardsley, 2007; Dillon, 2009; McKinney et al., 2007; Shakrani, 2008; Waddell, 2010). Science teachers with a strong sense of self-efficacy believe that they can effectively teach science and increase overall student achievement. This type of positive reinforcement has been shown in the literature to promote retention (Swackhamer, Koellner, Basile, & Kimbrough, 2009). Finally, science teachers' opportunity to further educate themselves through purposeful professional development can lead to better curriculum design and instructional implementation. This, in turn, can lead to gains in student achievement, overall job satisfaction, and thus, increased retention rates (Jeanpierre, Oberhauser, & Freeman, 2005; Loucks-Horsley et. al, 2009; Meyer, 2005).

To date, there has not been a study that examined if a statistical relationship existed between science teacher retention and school climate, science teacher efficacy, and professional development. This investigation attempted to build upon existing research regarding teacher retention (Darling-Hammond, 2003; Dillon, 2009; Hanushek, Kain, & Rivken, 2004; Ingersoll, 2006; Sterling, 2004; U.S. Department of Education, 2011; Westerlund, Radcliffe, Smith, Lemke, & West, 2011) by attempting to find a statistical relationship between science teacher retention in urban schools and school climate, science teacher efficacy, and professional development. Results from the Science Teacher Retention Factors Instrument showed that a statistical relationship does exist between school climate, science teacher efficacy and science teacher retention. Professional development has no influence on science teacher retention.

Conclusions and Discussion

As a result of the study, the following conclusions were drawn.

1. There is a relationship between school climate and science teacher retention in urban schools.
2. There are gender differences in regards to school climate. Male science teachers with five years' experience reported healthier climates than female science teachers with the same level of experience. Female science teachers with 30+ years experience reported healthier climates than male science teachers with the same level of experience.
3. There is a relationship between science teacher efficacy and science teacher retention in urban schools.
4. There is very little difference in the professional development experiences and applications of knowledge acquired as a result of science teachers, regardless of years of experience.
5. The best predictors of science teacher retention in urban schools are school climate and science teacher efficacy.

School Climate

Healthy school climates are characterized by many of the same attributes stressed in the effective schools literature: an orderly and serious environment, visible rewards for academic achievement, influential principals who blend their behaviors to fit the situation, openness in conduct, and a cohesive work unit based upon mutual trust. Each of the OHI-S's seven subscales was tailored to assess specific components of school health. Institutional Integrity served as an indicator of health at the institutional level. Initiating Structure, Consideration, Principal Influence, and Resource Support provided measures of the health of the managerial system.

Morale and Academic Emphasis were the indices of health at the technical level. In this investigation, there were some inconsistencies with three of the school climate subscales: Institutional Integrity, Principal Influence, and Morale, so it makes subsequent findings regarding school climate and science teacher retention questionable. It was determined that a weak, negative statistical relationship existed between school climate and a science teacher's years of experience in an urban school. An effective school leader should positively influence teacher commitment and retention, and when principals communicate clear expectations, provide assistance and support teachers, then their teachers experience greater professional commitment. Strong school management is essential to retaining teachers and fosters a climate where students will be successful (Hirsch, Emerick, Church, & Fuller; 2006). The finding indicates that a positive school climate has the opposite effect on the retention of science teachers.

As far as gender differences, male science teachers with five years' experience reported that their schools have a healthier climate than their female counterparts, and female science teachers with 30+ years' experience reported that their schools have a healthier climate than their male counterparts. There is not much in the literature regarding gender differences and school climate. In their study of science teachers and school environments, Huang and Fraser (2009) determined that teachers' perceptions of the school environment are influenced by a great variety of factors, including gender. They found that female high school teachers reported more positively than their male colleagues on measures of job satisfaction, collegiality, teacher–student relations, student discipline, ethnic equity, and teacher influence. The findings for the current investigation neither support nor undermine Huang and Fraser's results. More research is necessary.

Science Teacher Efficacy

Teachers' sense of efficacy has been shown to be a significant indicator of effective teachers. One would expect an effective teacher to have well-structured pedagogical and content knowledge and consequently, a higher sense of teaching efficacy. When this is applied to the science classroom, one can infer that if teachers have low science teaching efficacy, they are likely to avoid using a variety of science teaching methods. Conversely, if teachers have confidence in their science teaching ability, science will be taught using a variety of techniques.

For this study, there is a weak, positive statistical relationship between science teacher efficacy and a science teacher's years of experience in an urban school. This finding is supported by the literature. According to the literature, teachers who are highly efficacious tend to remain in the profession; they report a greater enthusiasm for teaching and express a desire to remain in teaching (Pas, Bradshaw, & Hershfeldt, 2012). Gender plays no role in a science teacher's sense of efficacy. The findings align with the previous research on science teacher efficacy and teacher retention.

Professional Development

When examining the data from the Teacher Activity Scale, the researcher decided to split the participants into two groups based on years of experience. Group A represents science teachers (N = 71) with five to 15 years of experience, and Group B represents science teachers (N = 32) with 16 to 30+ years of experience. Splitting the data in this manner made it easier to notice trends and patterns. There was little difference in the professional development experience and applications of the resultant acquired knowledge between Group A teachers and Group B teachers. The trends go as expected: science teachers with more experience are better

able to adapt what they have learned in professional development than science teachers with less experience.

Group B teachers participated in a greater variety of professional development activities than Group A teachers. Having taught for at least 16 years, these teachers are more likely to look for novel content or experiences to enrich their knowledge. Group B teachers were involved in study groups and individual research projects, made use of teacher resource centers and attended out-of-district workshops, state and regional conferences. Comparatively, Group A teachers, with at most 15 years of experience, are more likely to be in attainment of another degree. Therefore, they took college courses, engaged in individual learning, were involved in mentoring programs and attended out-of-district conferences.

The researcher made note as to why more Group A teachers attended out-of-district conferences and why more Group B teachers attended out-of-district workshops. Clarification of the difference between workshops and conferences was required to understand the finding. A workshop is a short-term training course where a small group of participants go to enhance a skill through an expert who demonstrates techniques. A conference is where a large congregation of people come together to attend a lecture on or discuss a broad range of topics. (Difference Between, 2013). With this understanding in place, it is not clear as to why more Group A teachers attended out-of-district conferences and Group B teachers attended out of district workshops. It would be logical to infer that science teachers with less experience are more likely to attend workshops where they can improve a particular skill or ability to enhance their teaching repertoire, and science teachers with more experience are more likely to attend a conference to learn more about a particular topic of interest as it relates to their discipline or

philosophy. However, this particular finding makes such an inference problematic. More study is required.

Teacher implementation of knowledge acquired through professional development.

Group A teachers experienced more issues regarding implementation than Group B teachers. A reasonable inference for this phenomenon is that Group B teachers were better able to implement what they learned in their professional development activities because they have more practical experience and know how to make adjustments to their curriculum and instruction. The only anomaly is when more Group B teachers reported that staying current with state standards was problematic. It can be deduced that Group A teachers were exposed to up-to-date techniques and norms in their college coursework and are more likely to tailor their curriculum and instruction to current state standards than Group B teachers, who may have to gain that knowledge from professional development.

Teacher improvement in knowledge, skills and abilities (KSAs) as a result of professional development.

More Group A teachers reported increases in their KSAs than Group B. This makes sense because Group A science teachers have less experience and more room to grow. Both groups reported low increases in developing strategies for ESL students and students for other cultures. A reasonable inference is that there is a significant lack of professional development that focuses on diversifying instructional techniques to the benefit of students from various backgrounds. Another area where all of the teachers reported low increases is in leadership development. This is another subject where there is a lack of professional development that is geared towards turning classroom teachers into leaders. It is an area better addressed in the context of educational leadership.

Teachers' changes in their teaching practices as a result of participation in professional development.

Group A and Group B teachers reported similar results with the exception of two areas. More Group A teachers reported making their content more challenging and more Group B teachers reported making changes in their instructional practices related to student diversity. The findings are consistent with the data from the other subscales; the teachers with less experience have more to learn and the teachers with more experience tend to make improvements in areas where they are lacking.

Teachers' perceived impact in student learning and engagement as a result of professional development.

Group A and Group B teachers returned similar results. With the exception of students' ability to use information to make connections, there was little difference in the data. In regards to that item, more Group A teachers claimed the phenomenon occurred than Group B teachers. A logical deduction for the results of this subscale is that when teachers make changes to their practices that make the content more accessible and/or relevant to the students, students do show improvement in practical abilities.

Relationship between professional development and teacher retention.

There is a positive correlation between professional development and science teacher retention. A reasonable inference is that teachers who are able to adapt, adjust, diversify and modify their curriculum and instructional methods tend to remain in the profession. This is supported by the literature. Darling-Hammond et al. (2009) showed that professional development that includes application of knowledge to planning and instruction has a greater chance of influencing teacher performance and leads to gains in student achievement. Teachers

who apply the knowledge gained from professional development experience the greatest amount of professional change (Darling-Hammond et al., 2009; Dass & Yager, 2009; Johnson & Marx, 2009). As far as gender, there were no significant differences, and as such, any differences are due to chance.

Best predictors among school climate, teacher efficacy, and professional development to impact science teacher retention in urban schools.

According to the model generated for this study, school climate and science teacher efficacy are the two biggest influences on science teacher retention in urban schools. However, the inconsistent findings within the school climate data make this conclusion questionable. As a result, it is better to conclude that science teacher efficacy is the best predictor of science teacher retention in urban schools. More research is necessary.

Recommendations

The findings in this study suggest that urban science teachers will continue to teach if they are highly efficacious and are in a strong, positive school climate. The following are some practical and theoretical recommendations for school systems and future research.

Practical Recommendations

Principals.

Research shows that principal support and influence is a significant factor in a teacher's decision to remain in a particular school (Boyd et al., 2009; Hirsh, Emerick, Church & Fuller, 2006; Ingersoll & Strong, 2011; MacNeil, Prater & Busch, 2009; Mishra & Acharya, 2011; Wynn et al., 2007), and the findings of this investigation support this. According to the finding from this study that indicates a relationship between school climate and science teacher retention

in urban schools, it is important for principals as school leaders to do the following: (a) protect the institutional integrity of a school because if the administration is able to shield the faculty and staff from external demands and allow the focus to be on academic emphasis, it will have the same positive impact on students, teachers and school climate in general; (b) help shape school environments that enhance science teacher satisfaction and promote retention by implementing a strong induction program that reflects the principal's personal involvement in interactions with new teachers, having an open-door policy for conversations, and assigning new teachers classes that are not heavily weighted with challenging students; and (c) overseeing a safe and orderly school environment with active support for teachers on disciplinary issues, maintaining a welcoming and respectful administrative approach toward the faculty, the staff, the students, the parents, school visitors, and taking active control in developing the leadership skills of the teachers.

As this study also determined that there is a relationship between science teacher efficacy and science teacher retention in urban schools, principals should create opportunities for teachers to elevate their personal stake and power in the school as an organization. This will have positive impacts on efficacy, school climate, satisfaction, and retention. These opportunities may come in the form of positive recognition, leadership roles, autonomy, teaching within-field, and freedom to plan and create lessons, and adapt the curriculum to meet the needs of students. Specifically, principals can include teachers in the decision-making process and seek teacher input on policy procedures and implementation. It is also beneficial to enlist the suggestions of the teachers when selecting teacher leaders and department chairs. The findings from this study indicate that there is a relationship between school climate and science teacher retention in urban schools.

Therefore, it is important for principals should ensure that there are adequate and appropriate resources, materials, and equipment for science labs, demonstrations and experiments.

Superintendents.

On par with the first conclusion drawn in this study, superintendents can impact retention by partnering schools with the highest attrition rates with university teacher education programs. Preservice teachers can gain experience in the urban science classroom under the tutelage of a veteran teacher. This can lead to the creation of a cohort of science teachers who are adequately prepared to teach in urban schools. Adding a strong mentoring component to this idea will reinforce the retention of these teachers as well as enhance teacher efficacy, which was the third conclusion drawn from this study. Superintendents should research and develop a strong induction or mentoring model that is consistent between schools of each level and not leave it up to individual schools to come up with their own induction or mentoring program for their new teachers because consistency matters.

Policy Makers.

District School Boards are responsible for several things, including setting individual school budgets, developing school agendas and creating policy. They also set goals and evaluate progress towards said goals. Being that they are responsible for school budgets, the financial impact of constant attrition is of great significance. Again, on par with the first conclusion drawn in this study, the Board can allot a portion of the budget strictly towards retention efforts and create policy that supports these efforts, especially when it comes to things such as resources, equipment, materials, and up-to-date classroom technology that is aligned with curriculum and state standards. These actions further reinforce what superintendents and principals can do to increase the retention of science teachers in urban schools.

Other Recommendations

Principals and superintendents.

These recommendations are not drawn from any specific findings in this study; rather, they reinforce what has been found in previous research and can reinforce retention if implemented with the aforementioned practical recommendations. Principals should seek the input and advice of teachers in determining the best and most appropriate professional development content that is needed by all of the teachers within the science department. In addition to other responsibilities, superintendents are responsible for overseeing the ongoing development of the curriculum and professional development for teachers. It benefits school systems to have several levels of professional development available for their science teachers. Novices need a variety of experiences designed to help increase their knowledge, skills, and abilities in ways that will impact their curriculum and instructional repertoire. Veteran teachers may require experiences that update and upgrade their knowledge to make it more in line with what is being delivered to teachers fresh out of teacher education programs.

Policy Makers.

Getting input from the district's science teachers as to what kinds of professional development is available is one way school boards can contribute to the retention of science teachers. There are many science institutes and programs available that offer discipline-specific professional development and are budget-conscious, such as the National Science Teachers Association, the National Oceanic and Atmospheric Administration, Science Discovery and the National Science Foundation. Colleges and universities could also offer discipline-specific professional development opportunities for science teachers. Offering science teachers partial reimbursement for attending these programs is another way to support their efforts to be more

efficacious educators. Making science teacher retention a long-term goal and establishing measures to ensure that it happens is something that school boards can do.

Future Research

The findings in this study suggested a relationship between school climate and science teacher retention. The three subscales that produced inconsistent results: Institutional Integrity, Principal Influence and Morale make the Pearson correlation that links school climate to science teacher retention suspect. Due to the discrepancy in the findings, this is something that should be further examined in terms of the individual subscales. The findings in this research also illuminate a relationship between a science teacher's outcome expectancy and retention, but further research on which elements of outcome expectancy affect retention would add to the existing understanding of science teacher efficacy. This study should also be carried out using domain-specific science efficacy instruments.

A finding that calls out for more study is conclusion number two: the gender differences in school climate among experience groups; specifically the five-year group and the 30+ year group. These two experience groups are at opposite ends of the teaching career cycle. What accounts for the significant differences in these two experience groups? This would be best addressed qualitatively in focus groups and individual interviews. Utilizing phenomenological research to examine the perspectives and philosophies of veteran science teachers, especially those with 30+ year experience, will provide a depth of valuable information that is missing from the literature. What do these teachers have to say about the profession that would encourage novices to remain in the profession beyond five years? What do they have to say about science teaching in general? What do they have to say about the specific kinds of support teachers need at varying levels of experience? This is something that would be best addressed using either

grounded theory or case study research and the findings would go a long way towards understanding concrete factors that keep science teachers teaching. Such information would be useful to principals and would definitely add to the body of research regarding gender differences in science education.

This investigation was performed with science teachers from urban schools, but it could easily be performed with science teachers from rural and suburban districts. Using science teachers from urban schools did not produce any noteworthy findings that would set them apart from science teachers in rural and suburban schools. Conducting this same study with these three groups and comparing the results will determine if there are actual differences in the retention levels of science teachers regardless of region, or if it is a phenomenon experienced only by teachers in urban and rural districts, as the literature suggests. It also is a good idea to compare science teachers at high-achieving urban schools with the science teachers at low-performing urban schools. It would be interesting to compare all of this data with the retention rates for science teachers in independent and/or private schools. Are there any discrepancies or distinctions in the perceptions of the science teachers at these schools? How do they compare in terms of retention? A longitudinal case study that compares the retention rates of science teachers from several schools would also be beneficial, especially if it includes a gender component.

Limitations of the Study

This investigation was designed to explore a statistical connection among teacher retention and preparation, school climate, efficacy and professional development. This study does not assume that retention is positively correlated with teacher success. Teacher success is an esoteric concept, and as such, must be defined before any qualitative statements or

correlations can be made. That is beyond the scope of this research. The study does not also attempt to describe effective professional development, as that is a subjective identifier left up to the discretion of the participant.

The study used purposive sampling, which decreased randomness. The participants were all secondary science teachers from urban school districts. However, there was no specification as to how many of the teachers were in middle school, and how many of the teachers were in high school. There is the issue of high school teachers potentially having more science content background than middle school teachers, which can affect science teacher efficacy. There is also the issue of domain-specific science teacher efficacy. The STEBI was designed for elementary school teachers, and this study focused on secondary science teachers. Frank Pajares (1996) wrote: “To be both explanatory and predictive, self-efficacy measures should be tailored to domain(s) of functioning being analyzed and reflect the various task demands within that domain.” Accordingly, there should be content-specific efficacy instruments for physics teachers, biology teachers, and chemistry teachers. At the time of this study, these instruments were not available.

School districts are restricted to one region of the United States, which can affect response bias. The sample of teachers from the database is not representative of the distribution of teachers nationwide. Systematic bias, which is a consistent difference between the results of a study and its ability to be generalized across a population, is a conceivable and likely result of the sampling restrictions. The results of the study can be skewed. There is the potential for significant response bias due to the number of participants who choose not to respond to the study. There is also the problem of a reduced participant pool due to the elimination of science

teachers who have less than five years in the science classroom. This can produce insufficient data with unreliable results.

Summary

This chapter reviewed the purpose of the investigation, discussed the results of the data analysis, answered the research questions, and attempted to draw reasonable conclusions and proposed practical recommendations for school administration and future research. There is a weak relationship between school climate and science teacher retention, as well as a weak relationship between science teacher efficacy and science teacher retention. The regression analysis produced a model that supported the above relationships. There is no relationship between professional development and science teacher retention. Results also showed significant differences between females and males in two different experience groups. Due to the disparity in some of the findings, it is reasonable to conclude that the above relationships may not actually exist, which supports a rationale for further study. The chapter concluded with suggestions for schools and for future research.

Epilogue

This study was undertaken after the researcher noticed the constant flux of science teachers in and out of an urban high school while working as a science teacher. The question of what factors contributed to those departures was worth investigating. When questioned, departing teachers typically quoted salary and lack of support, but since no teacher goes into the profession with the intent to become wealthy, that response was partially suspect. Salary only became a concern when teachers got frustrated with their workload, with administrative issues, and with student problems. Then, the mentality turned into, “I don’t get paid enough for this,”

and the teachers left for better opportunities. There is a line here and this researcher wanted to know approximately where that line was. From the research, and from the findings in this study, it appears that the line lies in the factor of school climate. This is not the least bit surprising. Problems such as a lack of support, a lack of materials, a lack of collegiality, and a lack of respect for the position make an already difficult job even more so.

These are variables that can be controlled. These are issues that can become non-issues. If administrators and school boards truly want to reduce the number of teachers that move in and out of schools, then they must make efforts to control said variables. They have to change the climate in such a way that it benefits the teachers. They have to make sure there is an adequate support system in place. They need to make sure the environment is conducive to learning. The superintendent should make sure the principal is able to do what's best for the students *and* the faculty, and make sure everyone knows exactly what that means. Happy teachers are productive teachers, and productive teachers tend to stay put. As the United States continues to drop in world rankings in terms of education, especially in science, it is imperative that schools and school districts do whatever it takes in order to stop that flow of movement and reverse it. This process begins with teacher retention.

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Appendix A
Consent Letter

Dear Participant,

My name is Kiyra B. Holt, and I am a graduate student at The University of Georgia, in the Department of Mathematics and Science Education, under the direction of Dr. Deborah J. Tippins. I would like to invite you to participate in my research study entitled Factors that Influence the Retention of Urban Science Teachers. The purpose of this study is to determine the best combination of factors that contribute to science teacher retention in urban schools.

You may participate if you are currently teaching science in an urban school, and if you have a minimum of five years of science teaching experience. You will be asked to complete an online survey, which will take no more than 20 minutes. Your involvement in the study is voluntary, and you may choose not to participate or to stop at any time without penalty. All of your information will be kept confidential and will be used in statistical analyses. The published results will be presented in summary form only.

The following link will provide access to the survey:

<https://www.surveymonkey.com/s/PXQF2F6>

If you have any questions about this research project, please feel free to send an e-mail to kiyra.holt@gmail.com. Questions or concerns about your rights as a research participant should be directed to The Chairperson, University of Georgia Institutional Review Board, 629 Boyd GSRC, Athens, Georgia 30602; telephone (706) 542-3199; email addressirb@uga.edu. Thank you for your consideration and participation.

Kiyra B. Holt

Appendix B

The Science Teacher Retention Factors Instrument

The Science Teacher Retention Factors Instrument (STRFI) has four components that measure organizational health, science teacher efficacy, professional development and demographics. There are also three free-response questions.

I. Organizational Health Inventory for Secondary Schools

The Organizational Health Inventory for Secondary Schools (OHI-S) has 44 attributes that are divided into seven clusters: Institutional Integrity, Initiating Structure, Consideration, Principal Influence, Resource Support, Morale and Academic Emphasis. The OHI-S is designed to measure overall school health.

A. Institutional Integrity. This cluster describes a school that has integrity in its educational program. The school is able to cope successfully with destructive outside forces. Please mark your responses below.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. Teachers are protected from unreasonable community and parental demands.				
2. The school is vulnerable to outside pressures.				
3. Community demands are accepted even when they are not consistent with the educational program.				
4. Teachers feel pressure from the community.				
5. Select citizen groups are influential with the board.				
6. The school is open to the whims of the public.				
7. A few vocal parents can change school policy.				

B. Initiating Structure: This cluster describes task- and achievement-oriented behavior. The principal makes his or her attitudes and expectations clear to the faculty and maintain definite standards of performance. Please mark your responses below.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. The principal asks that faculty members follow standard rules and regulations.				
2. The principal makes her or his attitudes clear to the school.				
3. The principals lets faculty know what is expected of them.				
4. The principal maintains definite standards of order.				
5. The principal schedules the work to be done.				

C. Consideration: This cluster describes principal behavior that is friendly, supportive and collegial. The principal looks out for the welfare of faculty members and is open to their suggestions. Please mark your responses below.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. The principal is friendly and approachable.				
2. The principal treats all faculty members as her or his equal.				
3. The principal puts suggestions made by the faculty into operation.				
4. The principal is willing to make changes.				
5. The principal looks out for the personal welfare of faculty members.				

D. Principal Influence: This cluster refers to the principal's ability to affect the actions of superiors. The influential principal is persuasive, works effectively with the superintendent, and simultaneously demonstrates independence in thought and action.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. The principal gets what he or she asks for from superiors.				
2. The principal is able to influence the actions of his or her superiors.				
3. The principal is able to work well with the superintendent.				
4. The principal's recommendations are given serious consideration by his or her superiors.				
5. The principal is impeded by the superiors.				

E. Resource Support: This cluster refers to a school where adequate classroom supplies and instructional materials are available and extra materials are easily obtained. Please mark your responses below.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. Extra materials are available if requested.				
2. Teachers receive necessary classroom supplies.				
3. Teachers are provided with adequate materials for their classrooms.				
4. Supplementary materials are available for classroom use.				
5. Teachers have access to needed instructional materials.				

F. Morale: This cluster refers to the sense of trust, confidence, enthusiasm, and friendliness among teachers. Teachers feel good about each other and feel a sense of accomplishment from their jobs. Please mark your responses below.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. Teachers do favors for each other.				
2. Teachers in this school like each other.				
3. Teachers are indifferent to each other.				
4. Teachers exhibit friendliness to each other.				
5. Teachers in this school are cool and aloof to each other.				
6. The morale of the teachers is high.				
7. There is a feeling of trust and confidence among the staff.				
8. Teachers accomplish their jobs with enthusiasm.				
9. Teachers identify with the school.				

G. Academic Emphasis: This cluster refers to the school's press for achievement. High but achievable goals are set for students, the learning environment is orderly and serious, teachers believe students can achieve, and students work hard and respect those who do well academically. Please mark your responses below.

	Rarely Occurs	Sometimes Occurs	Often Occurs	Very Frequently Occurs
1. The students in this school can achieve the goals that have been set for them.				
2. The school sets high standards for academic performance.				
3. Students respect others who get good grades.				
4. Students seek extra work so that they can get good				

grades.				
5. Teachers in this school believe that their students have the ability to achieve academically.				
6. Academic achievement is recognized and acknowledged by the school.				
7. Students try hard to improve on previous work.				
8. The learning environment is orderly and serious.				

II. The Science Teacher Efficacy Belief Instrument

The Science Teacher Efficacy Belief Instrument (STEBI-A) is designed to measure a teacher's perception in her or his own effectiveness as a science teacher, as well as the perception of her or his power to control student outcomes. The STEBI-A has 25 attributes that are divided into two clusters.

A. Personal Teacher Efficacy refers to supervisory style, which may be defined in terms of task-oriented behavior and person-oriented behavior. Please mark your responses below.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. I am continually finding better ways to teach science.					
2. Even when I try very hard, I do not teach science as well as I do most subjects.					
3. I know the steps necessary to teach science concepts effectively.					
4. I am not very effective in monitoring science experiments.					
5. I generally teach science ineffectively.					
6. I understand science concepts well enough to be effective in teaching					

current science courses.					
7. I find it difficult to explain to students why science experiments work.					
8. I am typically able to answer students' science questions.					
9. I wonder if I have the necessary skills to teach science.					
10. Given a choice, I would not invite the principal to evaluate my science teaching.					
11. When a student has difficulty understanding a science concept, I am usually at a loss as to how to help the student understand it better.					
12. When teaching science, I usually welcome student questions.					
13. I do not know what to do to turn students on to science.					

B. Outcome Efficacy is the teaching work group and the social aspects of the school setting. Please mark your responses below.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. When a student does better than usual in science, it is often because the teacher exerted little extra effort.					
2. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.					
3. If students are					

underachieving in science, it is most likely due to ineffective science teaching.					
4. The inadequacy of a student's science background can be overcome by good teaching.					
5. The low science achievement of some students cannot generally be blamed on their teachers.					
6. When a low-achieving child progresses in science, it is usually due to extra attention given by the teacher.					
7. Increased effort in science teaching produces little change in some students' science achievement.					
8. The teacher is generally responsible for the achievement of students in science.					
9. Students' achievement in science is directly related to their teacher's effectiveness in science teaching.					
10. If parents comment that their child is showing more interest in science at school, it is probably due to the performance of the child's teacher.					
11. Effectiveness in science teaching has little influence on the achievement of students with low motivation.					
12. Even teachers with good science teaching					

abilities cannot help some kids to learn science.					
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III: The Teacher Activity Survey

The Teacher Activity Survey (TAS) measures the extent of a teacher's professional development activities. It has two components: structural features and core features. Structural features are the organization of the professional development activity. Core features are the characteristics of the professional development activity. For each question item, please select the response that best represents your experience.

1. In the past school year (2010-2011), did you participate in any of the following types of professional development related to your science teaching?

	Yes	No
a. Within-district workshops or institutes.		
b. Courses for college credit.		
c. Out-of-district workshops and institutes.		
d. Teacher collaboratives or networks.		
e. Out-of-district conferences.		
f. Immersion or internship activities.		
g. Receiving mentoring, coaching, lead teaching, or observation.		
h. Teacher resource center.		
i. Committees or task forces		
j. Teacher study groups		
k. Other forms of organized professional development related to science teaching.		

2. In the past school year (2010-2011), did you participate in any of the following types of individual professional development related to your science teaching?

	Yes	No
a. Individual research project.		
b. Individual learning.		
c. Attending a state/regional science teacher conference.		
d. Attending a national/international science teacher conference.		

3. Have you attempted to adjust your teaching practices because of your participation in professional development activities?

Yes	No

4. Please rate the following statement: I think my knowledge and skills have been enhanced in each of the following areas as a result of my participation in professional development activities. Please mark your responses below.

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
a. Curriculum					
b. Instructional methods					
c. Approaches to assessments					
d. Use of technology in instruction					
e. Developing strategies for ESL students					
f. Developing strategies for students of other cultures					
g. Deepening knowledge of science					
h. Leadership development					
i. Adapting teaching to meet state assessment					

requirements					
j. Adapting teaching to meet state standards or curriculum framework requirements					
k. Learning about state assessments in professional development					
l. Learning about state standards or curriculum frameworks in professional development					

5. Did any of the following issues arise in your efforts to introduce changes in your teaching based on your experience in professional development activities? Please mark your responses below.

	Yes	No
a. Insufficient planning time		
b. Inadequate classroom materials		
c. Resistance from other teachers		
d. Resistance from administrators		
e. Resistance from parents		
f. Class sizes too large to implement		
g. Conflict between changes and needs		
h. Conflict between changes and state		
i. Insufficient opportunity to practice		

6. In which of the following areas did you make changes in your teaching practices as a result of your participation in professional development activities? Please mark your responses below.

	Yes	No
a. Science curriculum content		
b. Cognitive challenge of science classroom activities		
c. Instructional methods I employ		
d. Types or mix of assessments I use to evaluate students		
e. Ways I use technology in instruction		
f. The approaches I take to student diversity		

7. Please rate the following statement: I think student learning and engagement have improved in the following areas as a result of my participation in professional development activities. Please mark your responses below.

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
a. Ability to memorize facts, definitions or formulas					
b. Conceptual understanding					
c. Ability to perform science procedures					
d. Ability to generate hypotheses					
e. Ability to collect, analyze and interpret data					
f. Ability to use information to make connections					
g. Positive attitudes regarding science					
h. Rate of attendance					

IV. Free Response Questions

1. What did you like about completing this questionnaire using Survey Monkey?
2. What problems did you have completing this questionnaire using Survey Monkey?
3. Do you have any suggestions for the improvement of this questionnaire?

V. Demographics

1. What is your gender?

Female Male

2. Which of the following best describes your age range?

21-30 31-40 41-50 51-60 60+

3. Which of the following is your highest attained degree?

Bachelor Master Specialist Doctorate

4. Which of the following best describes your years of employment as a science teacher?

0-5 6-10 11-15 16-20 21-25 26-30 30+

5. Which of the following best represents your current teaching assignment, if any?

Life Sciences (Biology, Anatomy, Oceanography)

Physical Sciences (Chemistry, Physics)

Earth Sciences (Geology, Astronomy)

Multiple Disciplines (example: Biology AND Chemistry)

6. Is your current teaching assignment your preferred science discipline to teach?

Yes No

7. Were you mentored in a formal induction program when you first arrived at your school?

Yes No

8. Which of the following best represents the number of years you have taught in an urban school?

1-5 6-10 11-15 16-20 21-25 26+

9. How many years have you taught at your current urban school?

1-5 6-10 11-15 16-20 21-25 26+

10. Which of the following best represents your ethnicity?

African Asian Black Latino Native American White Other

Appendix C

Supplemental Figures

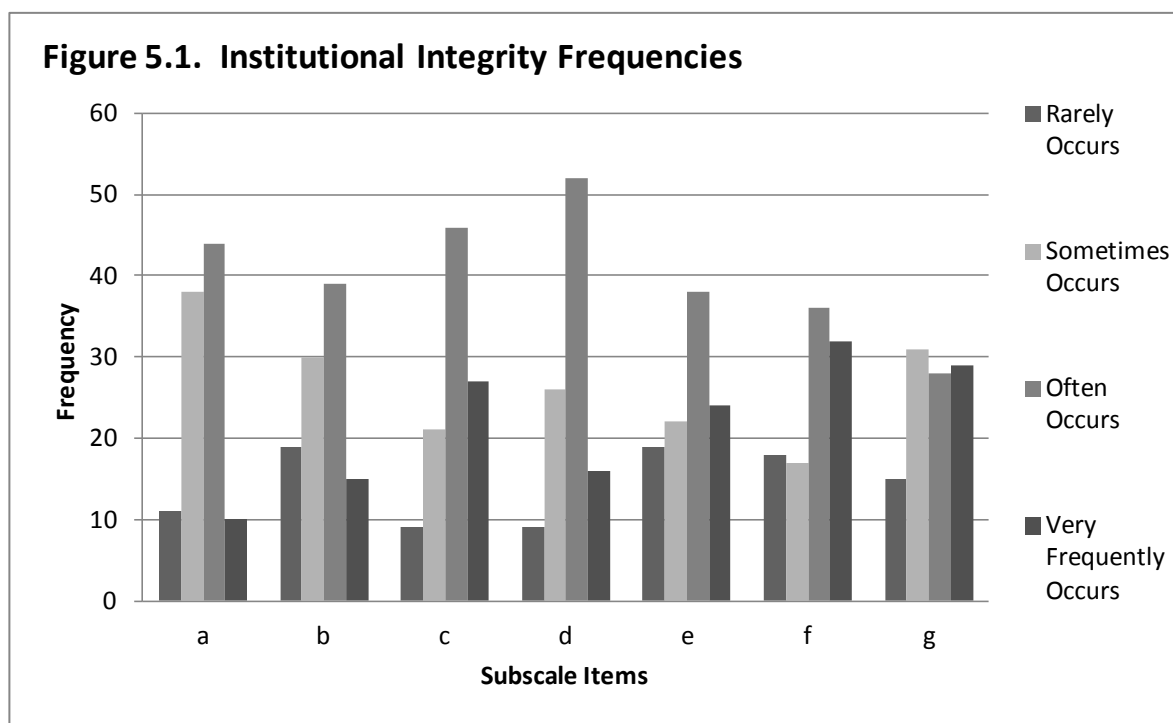


Figure 5.1. Participant responses to the Institutional Integrity cluster. Items: (a) Teachers are protected from unreasonable community and parental demands, (b) The school is vulnerable to outside pressures, (c) Community demands are accepted even when they are not consistent with the educational program, (d) Teachers feel pressure from the community, (e) Select citizen groups are influential with the board, (f) The school is open to the whims of the public, and (g) A few vocal parents can change school policy.

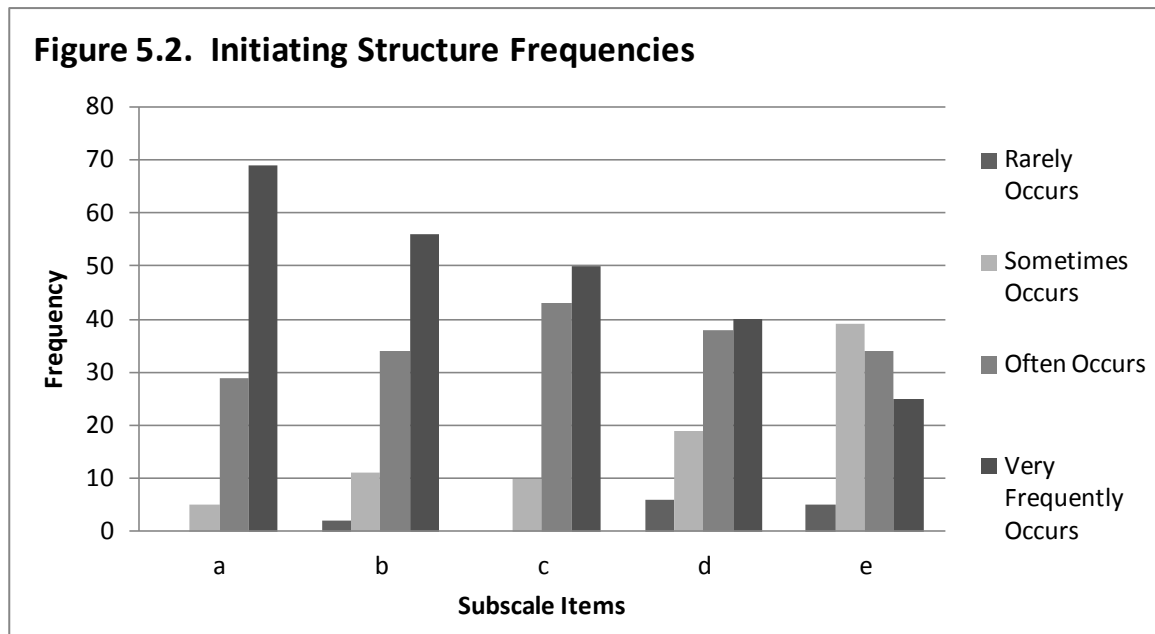


Figure 5.2. Participant responses to the Initiating Structure cluster. Items: (a) The principal asks that faculty members follow standard rules and regulations, (b) The principal makes her or his attitudes clear to the school, (c) The principals lets faculty know what is expected of them, (d) The principal maintains definite standards of order, and (e) The principal schedules the work to be done.

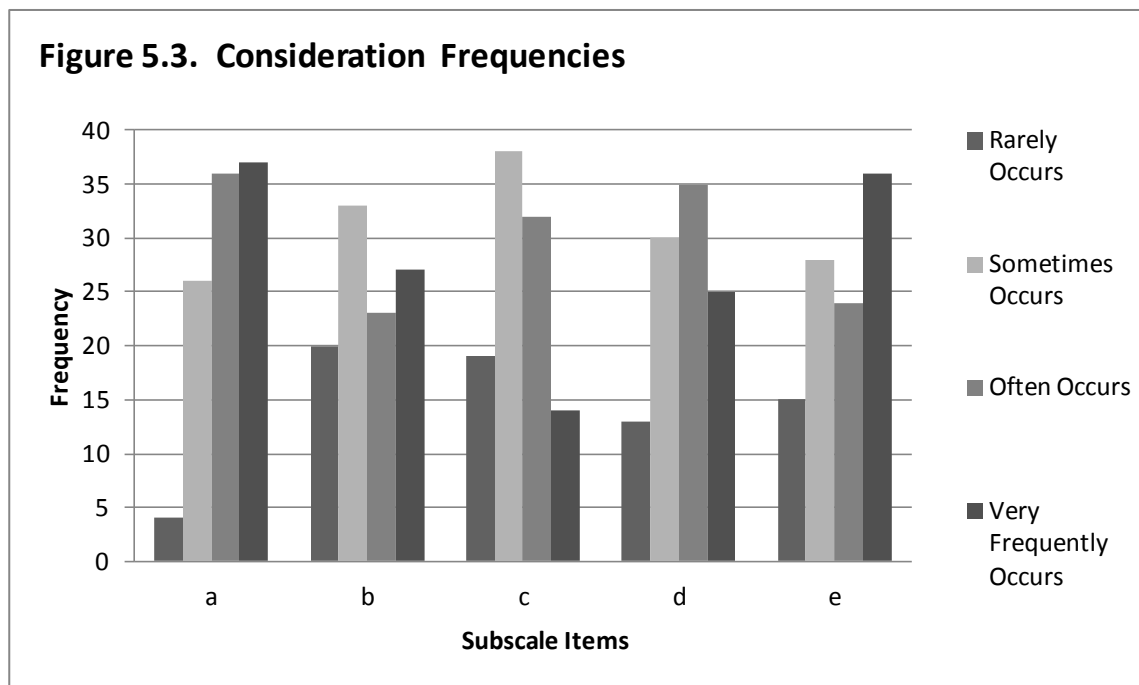


Figure 5.3. Participant responses to the Consideration cluster. Items: (a) The principal is friendly and approachable, (b) The principal treats all faculty members as her or his equal, (c) The principal puts suggestions made by the faculty into operation, (d) The principal is willing to make changes, and (e) The principal looks out for the personal welfare of faculty members.

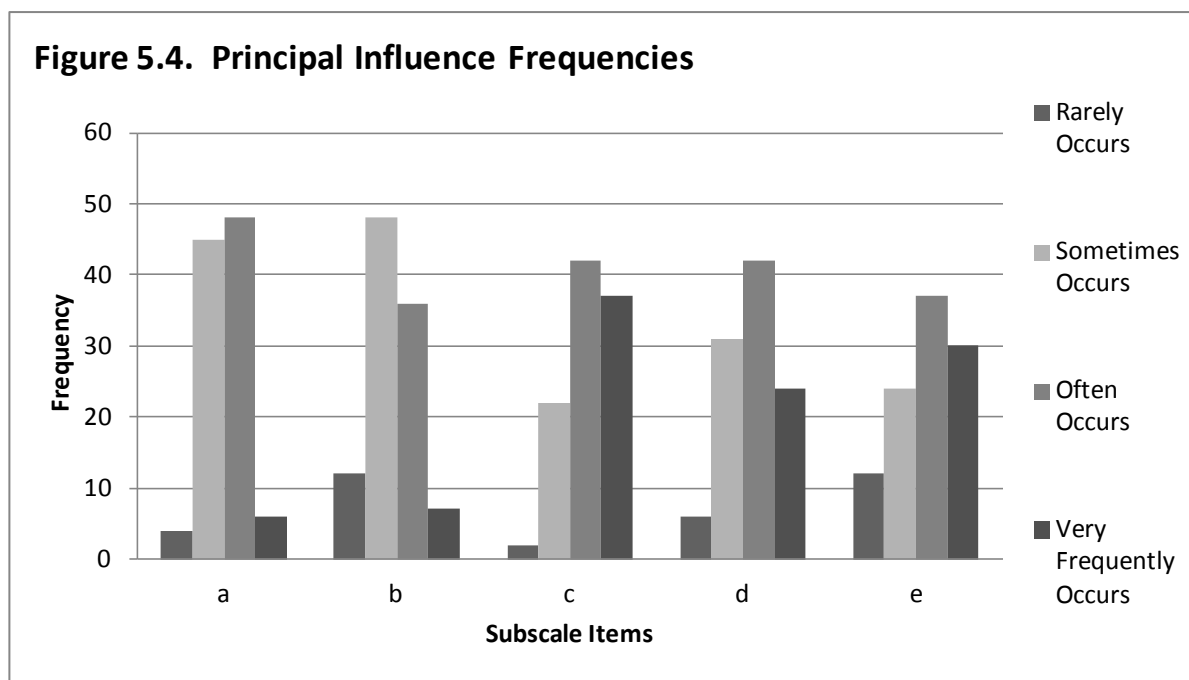


Figure 5.4. Participant responses to the Principal Influence cluster. Items: (a) The principal gets what he or she asks for from superiors, (b) The principal is able to influence the actions of his or her superiors, (c) The principal is able to work well with the superintendent, (d) The principal's recommendations are given serious consideration by his or her superiors, and (e) The principal is impeded by the superiors.

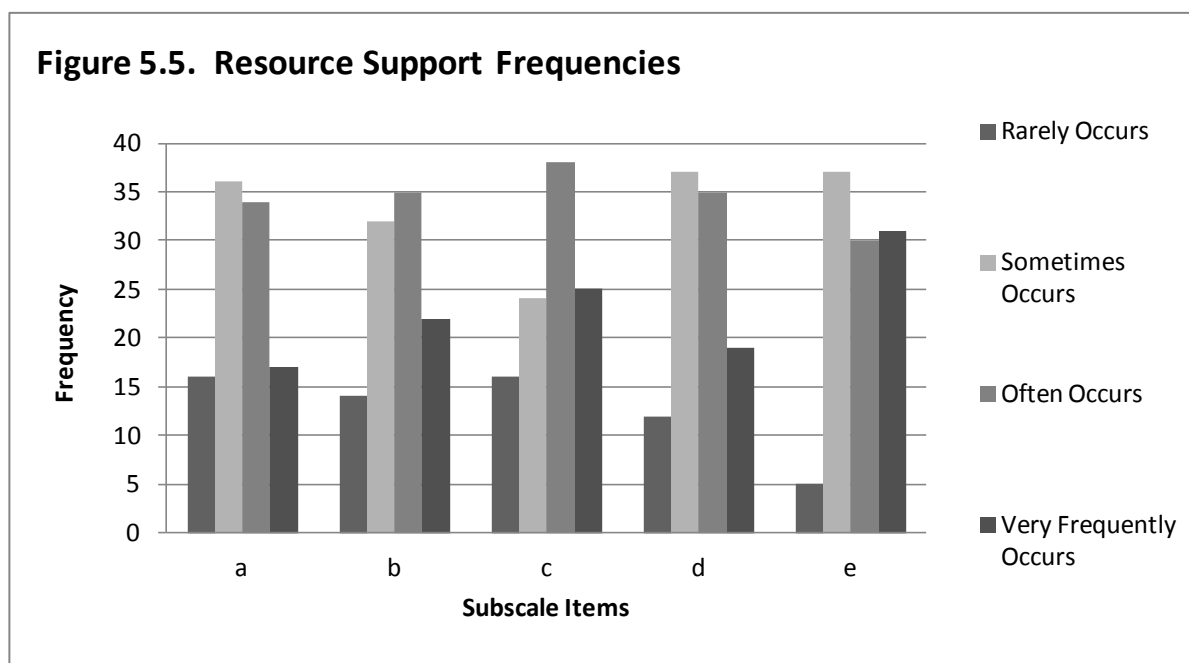


Figure 5.5. Participant responses to the Resource Support cluster. Items: (a) Extra materials are available if requested, (b) Teachers receive necessary classroom supplies, (c) Teachers are provided with adequate materials for their classrooms, (d) Supplementary materials are available for classroom use, and (e) Teachers have access to needed instructional materials.

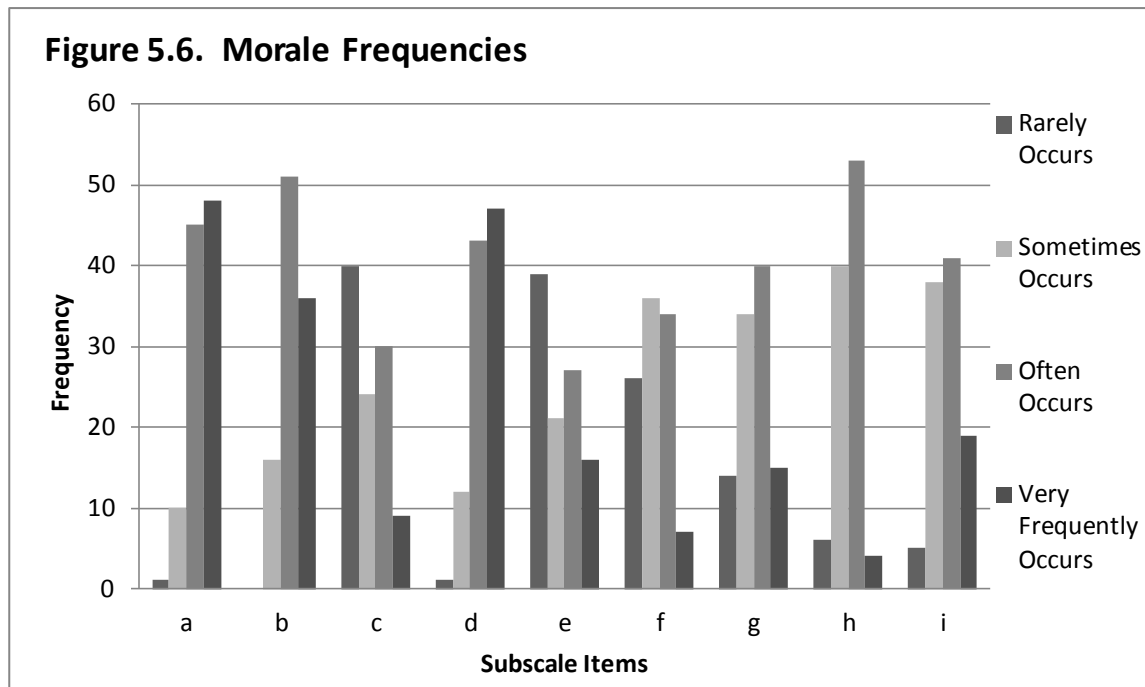


Figure 5.6. Participant responses to the Morale cluster. Items: (a) Teachers do favors for each other, (b) Teachers in this school like each other, (c) Teachers are indifferent to each other, (d) Teachers exhibit friendliness to each other, (e) Teachers in this school are cool and aloof to each other, (f) The morale of the teachers is high, (g) There is a feeling of trust and confidence among the staff, (h) Teachers accomplish their jobs with enthusiasm, and (i) Teachers identify with the school.

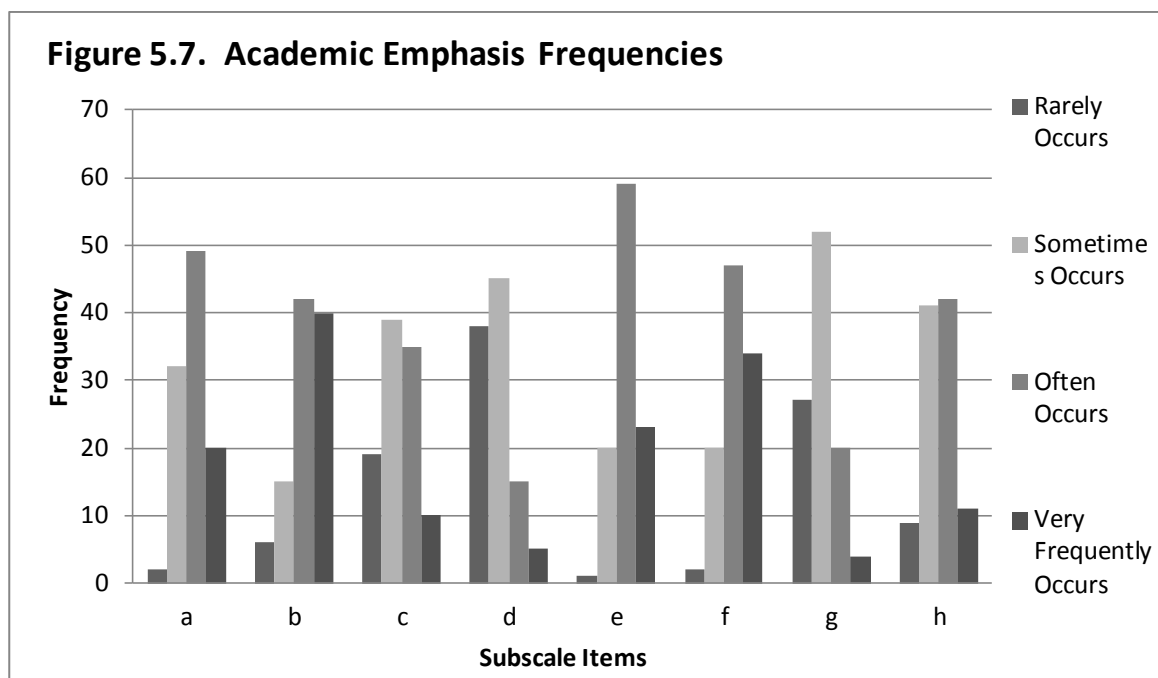


Figure 5.7. Participant response to the Academic Emphasis cluster. Items: (a) The students in this school can achieve the goals that have been set for them, (b) The school sets high standards for academic performance, (c) Students respect others who get good grades, (d) Students seek extra work so that they can get good grades, (e) Teachers in this school believe that their students have the ability to achieve academically, (f) Academic achievement is recognized and acknowledged by the school, (g) Students try hard to improve on previous work, and (h) The learning environment is orderly and serious.