2013

Factors Affecting the Retention of First-career and Second-career Science Teachers in Urban High Schools

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Factors Affecting the Retention of First-career and Second-career Science Teachers in Urban High Schools

A Dissertation

Presented

by

Rosemary C. Rak

Submitted to the Graduate School of Lesley University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

May 21, 2013

School of Education

Lesley University

School of Education

Ph.D. EDUCATIONAL STUDIES WITH A SPECIALIZATION

IN EDUCATIONAL LEADERSHIP

Dissertation Approval Form

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Dissertation Title: Factors Affecting the Retention of First-career and Second-career Science Teachers in Urban High Schools

School: Lesley University School of Education

Degree for which dissertation is submitted: Ph.D. in Educational Studies with a Specialization in Educational Leadership

This Dissertation meets the academic standards as to content and style for the degree of Doctor of Philosophy.

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Abstract

The turnover of high school science teachers is an especially troubling problem in urban schools with economically disadvantaged students. Because high teacher turnover rates impede effective instruction, the persistence of teacher attrition is a serious concern. Using an online survey and interviews in a sequential mixed-methods approach, this study investigates the perceptions of high school science teachers regarding factors that contribute to their employment decisions. The study also compares first-career and second-career science teachers' perceptions of retention and attrition factors and identifies conditions that urban school leaders can establish to support the retention of their science teachers. A purposeful sample of 138 science teachers from urban area New England public high schools with 50% or more Free and Reduced Price Lunch-eligible students participated in the survey. Twelve survey respondents were subsequently interviewed. In accord with extant research, this study's results suggest that school leadership is essential to fostering teacher retention. The findings also reveal the importance of autonomy, professional community, and adequate resources to support science instruction. Although mentoring and induction programs receive low importance ratings in this study, career-changers view these programs as more important to their retention than do first-career science teachers. Second-career interviewees, in particular, voice the importance of being treated as professionals by school leaders. Future research may examine the characteristics of mentoring and induction programs that make them most responsive to the needs of first-career and second-career science teachers. Future studies may also investigate the aspects of school leadership and professional autonomy that are most effective in promoting science teacher retention.

Keywords: career-changers; school leaders; science teachers; second-career teachers; teacher retention; teacher turnover; urban high school

Dedication

With love, to my family

Acknowledgements

Many individuals have contributed to my growth during this doctoral program and to my successful completion of this dissertation. I first want to acknowledge the guidance, encouragement, and assistance provided by my committee. Dr. Mary McMackin, my advisor, has been invaluable in guiding, encouraging, and supporting me throughout Phases II and III of this doctoral program. I have benefited greatly from her expertise, insightful comments, and constructive and timely feedback. Throughout the research and writing process, her reassuring words and her commitment to my success have kept me motivated. I am grateful to Dr. Albert Liau for introducing me to relevant fields of study, new and interesting research connections, and the power of visuals to communicate ideas effectively. I also want to thank Dr. Gerald Croteau, retired Superintendent of the Taunton Public Schools, for enriching my research with his thoughtful insights, extensive experience, and passion for the education of economically disadvantaged students.

Along the way, many others have supported my research in a variety of ways. I want to thank Dr. Marion Nesbit, Dr. Valerie Shinas, and Dr. William Stokes for their contributions and advice, and Lesley graduate student, Jenn Bogard, who was most helpful in recommending resources for my research. I am also very grateful to Dr. Salvatore Terrasi for providing statistical advice at critical times during the design and execution of my study. Special thanks go to my independent readers and coders: Kendra Rickerby, Linda Croteau, and Bob Rak, and to Lawrence Ferreira for reviewing my survey.

My colleagues in science education have my gratitude for their assistance. I want to thank Betsey Clifford, Massachusetts Association of Science Teachers (MAST) President, David Pierce, Massachusetts Science Education Leadership Association (MSELA) Membership

Chairman, and Wendell Cerne, MSELA Vice-President for facilitating my recruitment efforts. I am also grateful to my science colleagues and friends in the Taunton High School Science Department for participating in my pilot study, and to Matt Mattos, Headmaster of Taunton High School, who provided me with encouragement and support throughout the program. I want to acknowledge, as well, the school leaders and teachers who supported my study. I appreciate the time and thoughtful responses of my survey participants, interviewees, and focus group members.

The Lesley University Doctoral Program has contributed to my professional and personal growth in ways I could not have anticipated when I began. My friends in Cohort 2010 have enhanced my growth through their insights, collaboration, and conversation. The learning experiences designed and provided by the doctoral program's faculty have been significant in fostering my development. I am grateful to all of my professors for challenging and expanding my thinking and developing my skills through assignments and conversations guided by their commitment to the education of all students. I also want to acknowledge with gratitude the guidance and assistance that Dr. Stephen Gould and Karen Shea have provided me along the way. Lastly, I want to thank the library staff, especially Constance Vrattos, and Dan Newman of the Center for Academic Achievement, for their services during my course of study.

Ultimately, I could not have pursued this endeavor without the support and encouragement of my family. I want to thank my mother, who has always encouraged me to pursue my dreams, for becoming my "research buddy" over the past year. I appreciate the help I received with building my list of contacts from my son, David. Finally, I cannot adequately express my gratitude to my husband, Bob. His understanding, technical advice, assistance, and readiness to listen are truly exceptional.

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CHAPTER ONE: INTRODUCTION

Teacher turnover has been a longstanding problem in America's schools. The unacceptable rates of teacher turnover persist in public schools in spite of numerous and diverse investigations to define its parameters, identify key contributing factors, and ultimately reduce its rate. For example, The Condition of Education 2011 report (Aud et al., 2011) has shown that teacher turnover in public schools increased from the 1988-89 academic year (13.5%) to 2008-2009 (15.6%), with more teachers leaving the profession in 2008-2009 (8%) compared to 1988-89 (5.6%).

This dissertation focuses on a particularly troubling area of teacher attrition: the turnover of science teachers in urban area high schools. Three driving forces prompted this study: (1) the seemingly intractable nature of teacher attrition, (2) the researcher's experience as a science teacher and supervisor, which has highlighted the need for effective and committed science teachers, and (3) the need for scientifically literate students with the interest and competency to pursue careers in health care, science, and engineering.

Science is among a group of school subjects that has shown chronic teacher retention problems (Baker & Keller, 2010; Clotfelter, Glennie, Ladd, & Vigdor, 2008; Klentschy & Molina-De La Torre, 2003, LaTurner, 2002; Ng & Peter, 2010). Early initiatives to address schools' staffing problems in science focused on recruitment, and there is evidence that these efforts have been successful (Ingersoll, 2011). For example, Ingersoll (2011) has shown that the supply of qualified science teachers between 1987 and 2008 was adequate to meet the increased demand that occurred at that time due to higher student enrollments and teacher retirements. Nevertheless, schools have continued to struggle to fill science positions. Teacher turnover creates the added demand for science teachers that contributes to ongoing deficits in science

teachers (Ingersoll, 2011). During the 2008-2009 academic year, 83.9% of science teachers remained in their positions (Aud et al., 2011). The 16.1% of science teachers who left their positions that year include teachers who moved to a different school as well as others who left teaching. Teacher turnover, whether caused by attrition from the profession or by teachers moving to other schools, produces replacement demands on the schools that lose teachers. A primary objective of this study is to identify retention factors that school leaders can address to strengthen the retention of their science teachers.

Professionals from science-related careers, who enter teaching as career-changers, can help address staffing issues (Resta, Huling, & Rainwater, 2001). Often the transition of career-changers into the teaching profession is challenging, but ultimately successful for the teacher and for his or her students. Yet sometimes the transition does not proceed well, and the career-changer subsequently leaves the position or the profession. This study seeks to examine and compare the perceptions of first-career and second-career science teachers regarding factors that foster their retention or may contribute to their decision to leave a position. With an improved understanding of the perceptions of these two groups of teachers, appropriate interventions could be developed to promote their retention.

Just as the degree of teacher turnover varies among school subject areas, so it also varies among communities. Teacher retention problems may occur, for example, in schools in urban settings (Brown, 2003; Donaldson & Johnson, 2011; Ingersoll & May, 2012; Marvel et al., 2007; National Commission on Teaching and America's Future (NCTAF), 2007; Watlington, Shockley, Guglielmino & Felsher, 2010), where poverty poses additional retention challenges (Ingersoll, 2001). Due to the serious effects teacher turnover can have on student achievement in such schools, schools in these communities are the focus of this inquiry.

This chapter begins with a description of the problem addressed by this dissertation study and describes its context. Following an explanation of the purpose of the study, three research questions that have framed the investigation are presented. Next, terms that are relevant to the study are defined to establish a common understanding of concepts integral to this research. Having established a conceptual foundation, the chapter continues with an explanation of the significance of the study and a discussion of its delimitations. Finally, the chapter concludes with an outline of the remainder of the dissertation.

Statement of the Problem

The US Bureau of Labor Statistics' projections for employment trends through 2020 ("Projections Overview," 2012) confirm the need for a workforce with technical training. Job projections for the next eight years predict a much higher demand for service-providing industries than for goods-producing industries. Of particular importance for the present study is the anticipated demand for services that will require scientific training. Healthcare and social assistance are at the top of the list for future growth in the service- providing industries. These service industries are expected to grow by 33% due to the aging US population, longer life expectancies, and the development of new treatments and technologies ("Projections Overview," 2012). Furthermore, "professional, scientific and technical services" comprise the second highest area of projected employment among the service industries ("Projections Overview," 2012, p. 7). Interestingly, "education services" ranks as the third highest category of service industry for anticipated growth ("Projections Overview," 2012).

Although data from the Bureau of Labor Statistics' (2012) document the need for a scientifically competent workforce, trends in higher education in the United States reveal a disconcerting reality. According to the 2012 report on the condition of education in the United

States (Aud et al., 2012), during the 2009 - 2010 academic year, 7.9% of Bachelor's degrees were awarded in health-related careers, 5.2% were awarded in the biological and biomedical sciences, 1.4% were awarded in the physical sciences and science technologies. By contrast, the highest percentage of Bachelor's degrees were awarded in the fields of business, management and marketing, and personal and culinary services (21.7%) and in the social services and history (10.5%) (Aud et al., 2012).

The mismatch between projected future employment needs and the fields of undergraduate study illustrates the need for American public schools to produce scientifically literate high school graduates. However, promoting science literacy will not be sufficient. American public schools also need to educate students who will be inspired and equipped for successful postsecondary study of science and health-related majors.

The task of preparing students for postsecondary study of science and its related fields falls upon public school teachers. Schools need highly qualified and effective science teachers to ignite a passion in students for studying these fields in college. The question arises, however, as to how to fill the positions in our public schools with competent and committed science educators.

A reexamination of the statistics presented earlier regarding undergraduate science majors, can highlight the severity of the problem of finding qualified science educators. During the 2009 - 2010 academic year, only 5.2% and 1.4% of undergraduate degrees were awarded in the fields of biological and biomedical sciences and physical sciences/science technologies, respectively (Aud et al., 2012). It is unlikely that most of those graduates intended to enter the teaching profession. On the contrary, it is more likely that most anticipated employment in more lucrative careers in business or industry. Thus, the statistics about undergraduate science majors

demonstrate that the pipeline for first career science educators may be weak. Similarly, the future supply of undergraduate education majors is not promising. The Condition of Education 2012 report (Aud et al., 2012) reveals that undergraduate education majors accounted for 6.1% of the degrees awarded in 2010, which represents a 6.3% drop in degrees awarded in education since the 1999 - 2000 school year (Aud et al., 2012).

The preceding review of future career trends and recent undergraduate education data highlights the value of second-career educators. Data from the National Center for Education Statistics (2008) suggest a growing trend in career-changers in education. The researcher prepared Figure 1.1 to illustrate the percentage of new teachers who were *delayed entrants* to public school teaching (individuals who had never been employed as K-12 teachers and who were not students the previous year) during the two decades from 1987 to 2008. While some of these *delayed entrants*, such as stay-at-home parents, may not have had another career, it is likely that these data reflect an established trend of career-changers in education.

The likelihood that this employment trend will continue in the future underscores the importance of the present study. These professionals are a potential source of highly skilled and knowledgeable science educators for teaching positions that might otherwise remain unfilled. Their successful transition into teaching and their retention can help to build the committed and effective science teacher workforce that is needed.

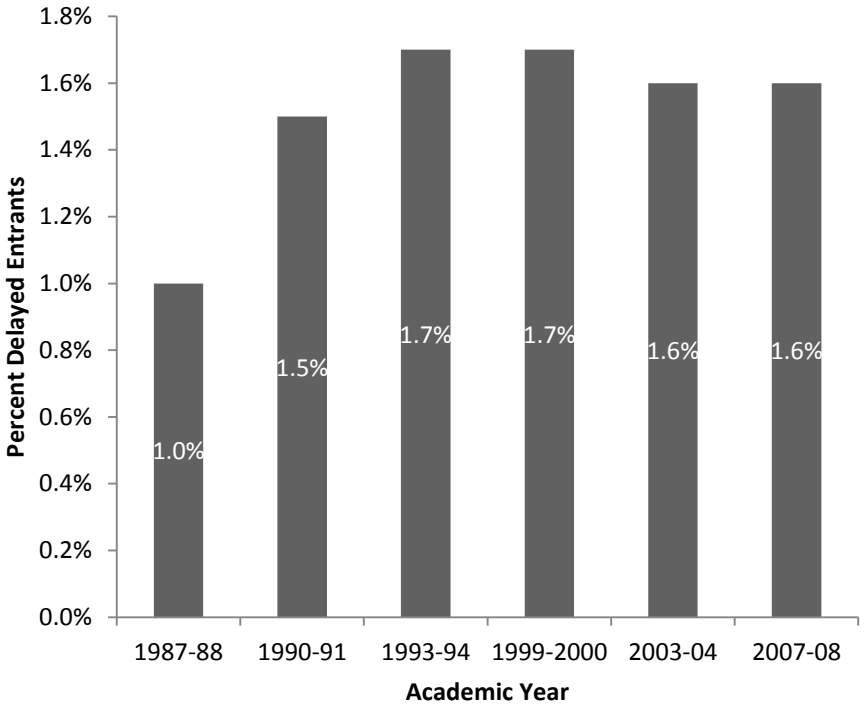

Figure 1.1. Percentage of new teachers who were delayed entrants to teaching. The researcher prepared the chart using data from the National Center for Education Statistics (2008).

Purpose of the Study

This study seeks to identify the conditions that promote the retention of science teachers in urban high schools. This investigation includes a comprehensive look at four categories of teacher retention factors: *Leadership*, *Professional Community*, *Mentor Programs*, and *Science Factors*. The inquiry also includes a less detailed review of *Induction Programs* and *Autonomy* as retention factors. Data for the analysis consist of science teachers' perceptions regarding the degree to which these factors contributed to their decisions to remain in or leave a position.

This study also examines the similarities and differences among the factors promoting the retention of first-career and second-career science teachers in urban high schools. While there is

ample literature addressing the broad field of teacher retention, comparisons of retention factors between first and second-career high school science teachers are limited.

There is reason to believe that there may be differences in factors that promote the retention of first-career and second-career educators. The support for this hypothesis can be found in literature that describes unique characteristics of career-changers (Chambers, 2002; Etherington, 2011; Resta, Huling & Rainwater, 2001). Prior employment experiences, knowledge and skills derived from previous work, and differences in stages of adult development might generate different needs, expectations, and perceptions among first-career and second-career teachers (Chambers, 2002; Etherington, 2011; Resta, Huling & Rainwater, 2001). The established trend of second-career educators warrants efforts to understand the factors that promote their retention. Greater understanding of career-changers' needs will provide school leaders with an improved focus for their retention efforts.

Research Questions

Three questions have guided this investigation of retention factors for science teachers:

1. What are the conditions necessary to retain science teachers in urban area high schools?
2. What are the similarities and differences in retention-promoting factors between first-career and second-career science teachers?
3. How do urban school leaders create the necessary conditions to foster retention of quality science teachers?

Definition of Terms

The following definitions are presented to clarify important concepts that inform this study.

Attrition – The loss of teachers from their teaching positions; includes teachers moving from one school or district to another and teachers who may choose to leave the profession.

Billingsley (1993) has asserted, "A number of different attrition-related terms have been used, such as *transfer, exit,* and *turnover*. However, there is little consensus about what these terms mean, and they are not used consistently across studies" (p.2). In light of the varied uses of *attrition,* it is important to clarify its usage here and to note that *turnover* is used synonymously with *attrition* in this study.

Career-changer – A teacher who had worked in a different career prior to teaching, for which he or she had received post-secondary education. In this study, career-changer is used synonymously with *second-career teacher*. This definition does not include the stipulation that the individual had completed at least three years of employment in a prior career (Hart Research Associates, 2010).

First-career teacher – A teacher who began his or her professional career by working in a teaching position for which he or she completed a post-secondary education.

Free and Reduced Price Lunch (FRPL) program – Part of the National School Lunch Program (NSLP) established under the National School Lunch Act of 1946 that provides free or reduced price lunches to children according to the following criteria:

> Children from families with incomes at or below 130 percent of the poverty level are eligible for free meals. Those with incomes between 130 percent and 185 percent of the poverty level are eligible for reduced-price meals, for which students can be charged no more than 40 cents. ("National School Lunch," 2013)

High school - A school with a maximum grade of 12 and a minimum grade of 7 (Institute of Education Sciences, 2012).

Induction program – A program presented by a school or school district for its new teacher employees to orient them to their new environment and to assist and support their transition (Ingersoll & Kralik, 2004; Ingersoll & Smith, 2004).

Mentor program – A program offered by a school or school district in which usually an experienced teacher supports a novice. Frequently mentoring programs are included with an induction program, sometimes the two terms are used interchangeably in the literature (Ingersoll & Smith, 2004), and sometimes a mentor program constitutes the school's induction program (Long et al., 2012). For the present study, the two terms are used discretely, with induction programs having a group focus while mentor programs use " a one-on-one process concerned with supporting individual teachers" (Wong, 2003, p.43).

Second-career teacher – A teacher who had worked in a different career prior to teaching, for which they had completed post-secondary education

Retention - Teachers remaining in their teaching positions for at least five years. The timeframe in this definition reflects studies that have produced estimates of 40% - 50% of new teachers leaving a teaching position within their first five years of teaching (Ingersoll, 2012; National Commission on Teaching and America's Future, 2003).

Turnover – For this study, *turnover* is synonymous with *teacher attrition*.

Urban schools – Schools that meet two criteria for this study:

1) Schools in communities categorized as *Large City*, *Midsize City*, *Small City*, or *Large Suburban* in the most recent database provided by the National Center for Education Statistics, 2009-2010 (Rural education in America, 2006)

2) Schools in which at least 50% of students are eligible for the Free and Reduced Price Lunch (FRLP) program.

Significance of the Study

The projected growth in scientific and technological careers through 2020 illustrates the need for effective science instruction in public schools. Quality science instruction can prepare students who choose to pursue postsecondary education in scientific and technological careers. Since science and technology majors are likely to obtain employment and achieve economic security in the future, it is essential that access to effective science instruction be equal for all public school students. Urban schools that serve diverse, and often poor, student populations must provide high quality mathematics and science instruction. If schools in high poverty settings do not offer quality science instruction, existing gaps in economic prosperity among socioeconomic groups are likely to persist.

Ultimately, the path to achieving effective science instruction in urban schools requires the recruitment and retention of effective science teachers. Linda Darling-Hammond (2012) has succinctly described the pivotal role of teachers in school improvement efforts,

> Educators know – and research confirms – that every aspect of school reform depends for its success on highly skilled teachers and principals, especially when the expectations of schools and the diversity of the student body increases. This may be the most important lesson learned in more than two decades of varied reforms to improve schools. Regardless of the efforts or initiative, teachers may tip the scale toward success or failure. (p. 8)

Bearing in mind the connection between effective teachers and effective instruction, the findings of this study may be of interest to individuals and groups interested in urban education improvements, generally, and in science education, specifically.

Because the perceptions of first-career and second-career teachers are compared in this study, subgroups of teachers and school leaders may find this study of interest. Second-career educators may benefit from an understanding of the issues and retention factors identified by their peers as promoting their retention. Career-changers who reflect upon their own circumstances in light of the findings of this study can actively seek the support they need to foster their success in their new teaching positions.

School leaders may be able to use the findings of this study to evaluate and improve their teacher induction programs, especially mentor programs. For example, knowledge of the primary factors that may influence teacher efficacy can inform the design of induction programs. Tailoring induction programs, including mentoring, to meet identified needs of first-career and second-career science teachers can enhance the relevancy and effectiveness of these programs. Veteran teachers, serving as teacher mentors, may also use the results of this study to inform their work with science teachers, thereby enhancing their effectiveness.

An understanding of factors affecting the first-career and second-career science educators under their supervision may also enhance the work of school and district administrators. Leadership practices, professional development offerings, and professional climate can be modified in response to school leaders' understanding of the specific factors that promote the retention of high school science teachers. Furthermore, this study seeks to identify the main factors that contribute to a teacher's decision to leave a position. Leaders' understanding of conditions that increase attrition promises to enhance their retention efforts as well.

Institutions of higher learning may use the results of this study to inform their pre-service teacher education programs. Because this study will focus on urban settings, it will address a field of interest for teacher education programs that seek to prepare new teachers for success in

urban schools. Furthermore, since the study addresses science, a field in need of quality educators, pre-service programs for second-career science teachers may be able to apply the study's findings in the design of their programs.

This study also promises to inform the work of policy-makers in supporting quality education for students in urban settings. Furthermore, it may shed light on ways to support the development of a viable Science, Technology, Engineering and Mathematics (STEM) workforce by retaining effective high school science teachers who can inspire students to pursue science-related education.

Through these applications, this study seeks to improve the retention of science educators in urban area high schools, which would enhance the learning experiences of their students. Improved science education for students, in turn, will potentially foster increased student interest in post-secondary study of science-related fields and support the development of a scientifically literate citizenry.

Delimitations of the Study

Existing research on teacher retention is abundant and diverse, with some studies examining factors that precede a teacher's first position, such as pre-service programs, and others focusing on factors involved during the early years of the teacher's employment, which is the focus of the present investigation. This study addresses four categories of retention factors that are under the control or direct influence of schools and school leaders: *Leadership*, *Professional Community*, *Mentor Programs*, and *Science Factors*. It also examines *Induction Programs* and *Autonomy* as retention factors. The present study does not investigate factors that are beyond the school's sphere of influence, such as pre-service training programs. Furthermore, since it is not a

longitudinal study, this investigation does not seek to calculate attrition rates of the teachers in the study population.

This study focuses on science teachers in urban area high schools in New England with at least half of the student body eligible for the Free and Reduced Price Lunch program. While the study's findings might be applicable to non-urban settings and academic disciplines other than science, the intent of this research is to focus on the retention factors affecting science teachers in schools with potential retention problems.

In order to limit the scope and focus of the investigation, this study does not attempt to differentiate between teachers' decisions to leave a position or to leave the teaching profession. Therefore, data on teachers' perceptions about attrition factors are collected without reference to whether they might leave the profession or move to a different school or district.

Chapter Outline

The dissertation contains five chapters, which are summarized here.

Chapter One presents the framework that guided the study. The chapter begins with a summary of the topic addressed in this study: the retention of science teachers in urban area high schools. Following this contextual description, Chapter One continues with a statement of the problem in light of projected employment needs in scientific and technological fields and current higher education enrollments in these fields of study. The discussion, which contrasts career projections with data regarding undergraduate majors, highlights the need for effective science teachers to prepare high school students for successfully studying science and related fields at the postsecondary level. Next, the factors that contribute to the retention of high school science teachers in urban area high schools is discussed. The purpose of the inquiry includes a comparison of first-career and second-career science teachers' perceptions about factors that

contribute to their retention or attrition. Three questions that have guided the research are presented, terms that are essential to an understanding of the study are defined, and the significance of the study is addressed by identifying the stakeholders for whom the study will be informative. Chapter One concludes with a description of the boundaries of the study's design. These delimitations help to frame the scope of the inquiry.

To establish the conceptual framework for this study, Chapter Two presents a review of the relevant literature. Because teacher turnover is a complex and long-standing issue, the literature review begins with an historical perspective, including the teacher attrition theory described by Grissmer and Kirby (1987). Diverse teacher retention studies are examined to reveal the primary factors that have been shown to affect the retention of teachers. The factors described in this review include financial considerations, pre-service training, induction and mentoring programs, school leadership, and collegial collaboration. The review continues with a discussion of the financial and educational costs associated with teacher turnover, especially in urban settings.

In order to establish a broader context for this study, employee retention is also examined from the perspective of private business and industry. Particular attention is given to the role of relational trust in the workplace. Next, current understandings of teacher retention factors are applied to the practice of school leaders.

The literature review continues by addressing the specific foci of this dissertation study, science teachers and second-career teachers. First, research addressing the retention of science teachers is discussed and summarized. Next, studies that have examined the perspectives and experiences of career-changers in education are described. To elucidate the factors that may

influence second-career teachers' viewpoints, the review summarizes adult learning theory, including transformative learning as described by Mezirow (2012).

Chapter Three explains how this study was designed to answer its three guiding research questions. The chapter provides a detailed explanation of recruitment efforts, participants, and the survey and interview instruments. In addition, the rational for the methodology and the management of data analysis are explained. Methods used to reduce validity threats and assess reliability, including the results of a small pilot study, are presented as well. The chapter concludes with a description of the limitations of the study, which affect the generalizability of its findings.

Chapter Four presents the quantitative and qualitative data using the study's three research questions as an organizational framework. First, the demographics of the survey and interview participants are presented, and then the views of interviewees regarding their reasons for pursuing a teaching career and their reflections about teaching in an urban school are summarized. Quantitative data derived from the online survey are analyzed to illustrate the relative importance of retention and attrition factors based on gender, age, and career status groups. Qualitative data, obtained from interview transcripts and open response survey items, are analyzed using an iterative process of coding, identification of code categories, and synthesis of themes. The summary analysis of the qualitative data illustrates how retention factors contribute to teachers' commitment to their schools.

Chapter Five begins with a brief summary of the study's purpose and overall design, followed by a discussion of the study's findings and their relationship to extant literature. This discussion is guided by the three research questions that provided the focus for the investigation. Next, implications for practitioners are explained, and recommendations for future research are

offered. A concluding statement summarizes the researcher's reflections on the findings of the study.

CHAPTER TWO: REVIEW OF THE LITERATURE

The retention of teachers in public schools has persisted as an area of concern in America's quest to provide a quality education for all of its children. With approximately 1/3 of teachers exiting the profession within five years of their employment (Darling-Hammond, 2003), and up to 50% of teachers leaving positions within five years in some school settings (Haberman, 2007; Ingersoll & Kralik, 2004; Ingersoll & Smith, 2003), the attrition problem in American schools is a serious one. Recently, the 2010 report on teacher mobility and attrition by the National Center for Education Statistics indicates that, of the public school teachers with 1 – 3 years of experience who were surveyed, 22.8 % either moved to another school or left teaching one year following the survey (Keigher & Cross, 2012).

Linda Darling-Hammond (2003) has asserted, "effective teachers constitute a valuable human resource for schools – one that needs to be treasured and supported" (p.7). With high teacher turnover rates, public schools face serious challenges in staffing their classrooms with quality teachers. Given this backdrop of the scope and significance of the teacher attrition problem, teacher retention warrants continued attention and intervention.

The problem of teachers leaving their positions within the first few years of teaching does not affect all public schools equally. For example, schools in high-need settings, such as urban school districts, are affected disproportionately by the negative impacts of teacher attrition (Watlington, Shockley, Guglielmo, & Felsher, 2010). High-need schools encounter both negative economic and educational consequences because of teacher attrition. Poverty, health concerns, and other out-of-school factors interfere with learning for children in high-need

settings (Berliner, 2009). Consequently, their need for quality instruction is great. Teacher attrition reduces their chances for the quality instruction they clearly need.

One measure of economic need in schools is the percentage of students who are eligible for Free or Reduced Price Lunch (FRPL). The National Center for Education Statistics publishes teacher attrition data with respect to a variety of school characteristics, including FRPL-eligible students (Aud et al., 2011). The researcher prepared Figure 2.1 to depict the relationship between teacher turnover and FRPL-eligible students in US public schools for the 2008-2009 school year. Schools with one quarter or less of their student population eligible for Free or Reduced Priced Lunch, showed a lower attrition rate than did other public schools.

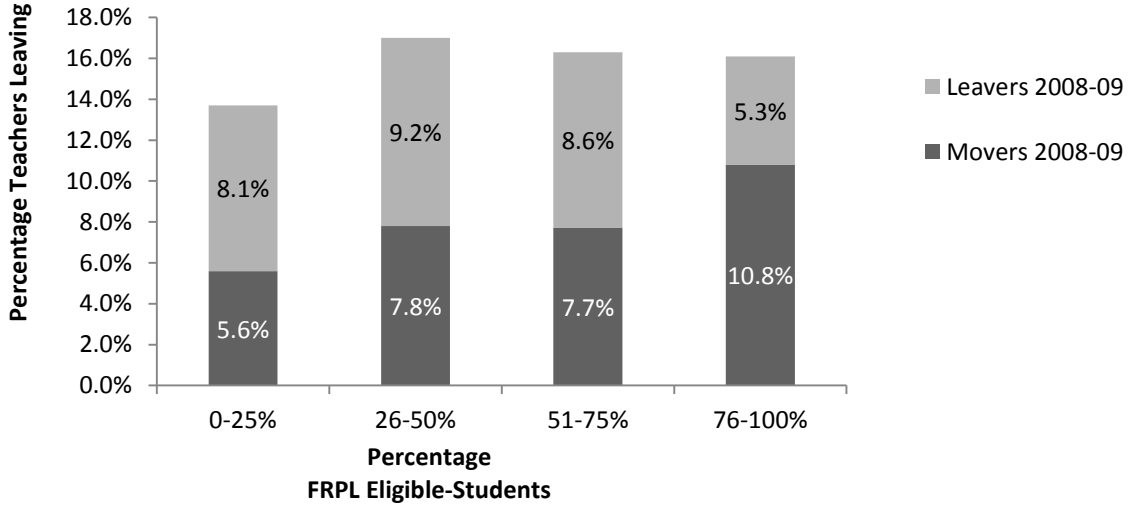

Figure 2.1. Percentage of teachers leaving the profession (*Leavers*) or moving to a new school (*Movers*) vs. percentage FRPL students. The researcher prepared the chart using data from the 2008-09 Teacher Follow-up Survey (TFS), Table a-32-2, obtained from Aud et al., 2011).

Teacher retention problems also vary among academic disciplines. Many have noted that some subjects, such as mathematics and science show higher rates of teacher attrition than other

subjects do (Baker & Keller, 2010; Clotfelter et al., 2008; LaTurner, 2002; Ng & Peter, 2010). Yet other evidence has indicated that science teacher turnover is roughly equivalent to other disciplines (Ingersoll, 2011). It is likely that different views on this issue stem from the complex and multi-faceted nature of teacher retention and differences in research methods. There is consensus, however, regarding our country's reliance on scientifically and mathematically literate citizens and trained professionals in these fields to ensure its economic growth and security. Quality science and mathematics teachers, who continue to improve their practice over time, are essential to building this citizenry and workforce.

Early efforts to address shortages of qualified teachers focused on recruitment (Ingersoll, 2001; National Research Council, 1992). In an article addressing the need for teachers of mathematics and science, Richard Ingersoll (2011) emphasizes the efforts that have been made at recruiting qualified teachers of these subjects to meet the need for these professionals. He asserts, however, that research has been lacking in confirming that recruitment is at the heart of the problem.

Contrary to the predominant belief that the supply of teachers was inadequate for available openings, Ingersoll (2011) cites data that show adequate supplies of qualified math and science teachers, with math teachers increasing by 74% and science teachers increasing by 86% over the past twenty years (Ingersoll, 2011). This study concludes with the assertion that teacher turnover is the primary reason for teacher shortages in math and science.

In those settings where teacher retention is a problem, it has an effect on student achievement because of its direct connection to classroom teacher quality. Teachers of high quality not only have the content background aligned with their particular teaching assignments,

but also have the skills of managing the classroom environment and organizing instruction (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010). Although the direct relationship between teacher quality and student achievement seems intuitively obvious, it is noteworthy that empirical studies have confirmed its import (Bryk et al., 2010; Miles & Frank, 2008). In fact, staffing classrooms with highly qualified teachers has been described as a priority over other factors that affect student achievement, such as reduced class sizes or increased instructional time (Miles & Frank, 2008).

This review begins by establishing the historical context for teacher retention problems in American schools. In order to define the problem and create a foundation of common understanding of this complex issue, teacher attrition theory and attrition studies are summarized. Studies that examine the financial and educational costs of high teacher attrition are described, revealing the severity and urgency of teacher retention issues. Teacher retention issues in America's urban school settings receive additional focus in this literature review. High need schools, defined by poverty levels and high diversity of the student population, are closely examined for the teacher attrition problems they face and the negative effects they endure. Studies that examine the diverse factors that influence teacher retention are highlighted with the goal of identifying the most salient teacher retention factors that schools can address directly. The categories of retention factors addressed are monetary compensation, pre-service programs, professional culture, school leadership, and induction programs, including mentoring programs. This review then examines the specific context for the present study: science teacher retention and the trend of second-career educators in K – 12 schools. This analysis of diverse literature underscores the complexities of teacher retention as well as the need for additional study and concerted efforts to improve the retention of effective teachers in American schools.

Historical Context of Teacher Attrition

High levels of attrition among teachers are not a recent phenomenon. Marianne Dove (2004) brings the problem of teacher turnover into an historical perspective. Referring to the earliest days of public schooling, she describes how public education created the demand for hundreds of thousands of females to serve as teachers. During the 19th century, however, these teachers would leave the profession after few years due to pregnancy and the ensuing home and family demands. Thus, the teaching profession, since its beginnings has shown a high turnover rate.

The demand for teachers continued through the 20th century as the number of years of schooling for students increased, enrollments grew, and attrition continued. In their 1987 report, Grissmer and Kirby noted that in the 1960s, teacher attrition rates ranged from 10 to 17%. To accommodate the high demand for teachers of certain subjects, emergency certificates were developed by state governments (Dove, 2004).

Dove (2004) has asserted that the awarding of emergency certificates, a practice that has continued in recent years, has had a negative effect on the status of the teaching profession. She proposes that the awarding of certificates to individuals with less than standard credentials has the undesirable consequence of reinforcing the public's low respect for the teaching profession. As will be described later, the lack of respect for teaching, and its ranking as a "second-rate" career by some, can erode some teacher's commitment to their positions and to their profession. In this way, emergency certification programs can influence teachers' decisions to leave the profession (Dove, 2004).

An examination of teacher attrition during the 21st century must be framed by recent employment and retention trends generally. It bears acknowledging, for example, that younger

generations, in general, are showing a tendency for reduced time spent in their careers (Santovec, 2010). This is true, for instance, for members of the Generation X, individuals born between 1965 and 1979, inclusive (McCrindle & Wolfinger, 2010). Typically, members of Generation X remain in a position for 5 to 8 years (Santovec, 2010). Members of Generation Y, or the Millennial Generation, are those who were born between 1980 and 1994 (McCrindle & Wolfinger, 2010). These individuals could be expected to have an even higher turnover rate (Santovec, 2010). Notwithstanding these trends, however, the characteristically high turnover rate of the teaching profession stands out.

Teacher Attrition Theory

It is useful to ground current interest in the factors contributing to teacher attrition in the context of early research. In their theory of teacher attrition, Grissmer and Kirby (1987) examined attrition with respect to the individual's life cycle. They described the pattern of teacher attrition as a U-shaped, or bimodal, curve. Figure 2.2 is provided as a sample bimodal curve. The descending arm of the U-shaped curve illustrates that the peak time teachers leave their positions is during their early years of employment, while the ascending arm of the curve reflects increased attrition during their later years as they approach retirement age. The middle of the bimodal curve illustrates that the rates of lowest attrition occur during teachers' midcareer years (Grissmer and Kirby 1987). Grissmer and Kirby (1987) also distinguished between attrition due to teachers leaving the profession and attrition caused by teachers moving within or between school districts.

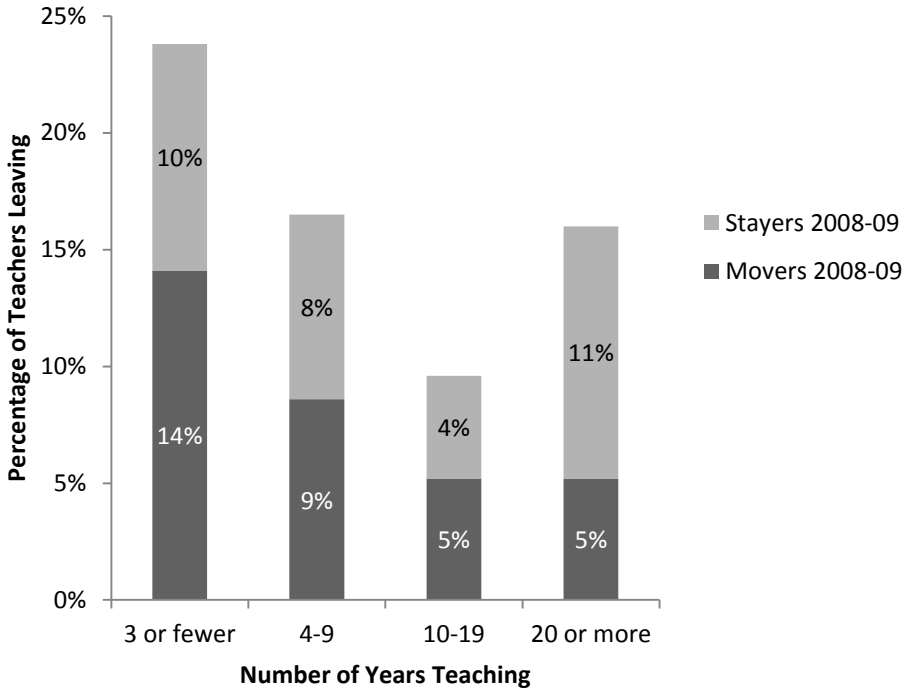

Figure 2.2. Percentage of teachers leaving the profession or moving to a new school over the course of their career. The researcher prepared the chart using data from the 2008-09 Teacher Follow-up Survey (TFS) obtained from Aud et al., 2011.

The theory of teacher attrition developed by Grissmer and Kirby (1987) acknowledges the complexities of teacher attrition. The combined effects of many factors result in the observed loss of teachers early in their careers. For example, the authors suggest that new teachers leave positions and move between positions for better pay, improved working conditions, or locations that are more desirable. They also propose that attrition may be due to a mismatch between job expectations, and the reality of the teaching career. Recent literature confirms the bimodal pattern and the complex nature of teacher attrition (Ingersoll, 2003; Johnson & Birkeland, 2003) and strives to explain the factors that contribute to it.

Grissmer and Kirby (1987) offer additional explanations for the remainder of the U-shaped or bimodal pattern of teacher attrition. The middle of the curve reflects the reduced attrition observed during a teacher's midcareer, when several factors work against a teacher

leaving. Deterrents to attrition include stage-of-life factors, such as fewer familial concerns and reduced reasons to relocate, as well as work factors, such as improved salaries, seniority, and the potential loss of pension and benefits. Finally, the observed increase in teacher attrition among veteran teachers is attributed to retirement eligibility (Grissmer & Kirby, 1987).

Efforts to understand and address teacher attrition reflect a variety of perspectives. Although the rate of attrition for the teaching profession is concerning, the most disconcerting data derive from studies based on subsets of teachers and particular school settings. For example, based upon 2007 data, teachers of science, mathematics, and engineering are more likely to leave the teaching profession rather than move between schools or districts (Alliance for Excellent Education, 2008). Other studies have confirmed that attrition rates vary with subject area. Special education, mathematics, and science, in particular, face significant teacher attrition concerns (Baker & Keller, 2010; Certo & Fox, 2002; Ingersoll, 2003). In addition, schools in high poverty communities face higher teacher turnover rates than do schools in other settings (Ingersoll, 2001). The costs of teacher attrition in urban settings, in particular, will be addressed later in this review.

Scope of the Teacher Attrition Problem

Employee attrition is, of course, not limited to the field of education. On the contrary, attrition is a natural aspect of all professions. It is also undisputed that attrition is necessary, and can be beneficial for an organization. Employees, who find that a particular job or position is not a "good fit" for them, likely enhance the organization when they leave voluntarily (Ingersoll, 2012). Similarly, an organization likely benefits when supervisors ask employees, who have been determined to be ineffective or ill-suited for position, to leave. Notwithstanding these examples of necessary and beneficial attrition, when turnover results from various types of poor

working conditions, it negatively affects an organization on many levels (Alliance for Excellent Education, 2008; Dove, 2004; McKinney, Berry, Dickerson, & Campbell-Whatley, 2007; Shockley, Guglielmino, & Watlington, 2006; Watlington, Shockley, Guglielmino, & Felsher, 2010).

The severity of the teacher attrition problem in public schools comes into focus when teacher turnover levels are compared to those of private enterprise. Marianne Dove (2004) has shed light on the severity of the turnover problem in educational settings:

> How can we believe that true efforts have been made for educational reform in developing countries, if we continue to accept high teacher turnover as a reality of schooling? Could American corporations afford to lose 30% of its workforce within five years of employees' entry as American school systems do? (p. 13)

Retention Factors

Monetary compensation. Perhaps the first factor that one would consider as influencing teacher retention in urban settings is monetary compensation. In fact, when salary leads to teachers' dissatisfaction with their assignment at a particular school, it can lead to increased attrition. This seems to be the case when salaries are below those of neighboring communities. In a study of seven Virginia school districts, including urban, suburban and rural settings, twenty teachers who exited their positions within their first five years responded to data-gathering interviews lasting for about twenty minutes (Certo & Fox, 2002). Among those respondents, insufficient salary was cited as one of three main reasons that teachers left their teaching positions. Insufficient salary was the third most frequent reason, while inadequate administrative support and stressful schedules occupied the top two explanations for their

departures. Ineffective leadership, in particular, is a recurring factor associated with teacher attrition to be discussed later.

In an effort to promote teacher retention, some teacher preparation programs and school districts have offered prospective teachers a bonus or other financial package for one or more years of teaching in an urban school (Clotfelter et al., 2008; Donaldson & Johnson, 2011). Teach for America (TFA) recruits high-achieving college graduates to teach in urban or rural schools for at least two years. Although Teach for America participants receive the same compensation as other first year teachers in their districts, TFA offers its participants a $1000 - $6000 transition funding package in their program. These funds support teachers' relocation costs, fees for teacher certification exams, and travel expenses for their summer training program ("Why teach for America," 2011). Statistics have shown that 56.4% of the Teach for America teachers leave their positions in low-income schools after two years, and only 14.8% remain in their original school placements by their fifth year (Donaldson & Johnson, 2011). These results suggest that the financial assistance received by the participants to ease their transition into teaching did little to promote teacher retention among a majority of the teachers.

Contrasting results have been observed in a study designed to investigate the effects of an annual $1800 bonus on the retention of science, math, and special education teachers in high-need public schools in North Carolina (Clotfelter et al., 2008). The overall goal of the three-year North Carolina Bonus Program was to improve the quality of instruction in these subjects in high-poverty schools and schools with low student achievement. The study revealed that the salary bonus improved teacher retention, with those who received the bonus showing a one-sixth reduction in turnover rates. Furthermore, improved retention rates were greatest among experienced rather than novice teachers. The authors suggest that since this salary intervention

reduced teacher attrition, it may offer a model for strengthening instruction and student achievement in high-need schools (Clotfelter et al., 2008).

Pre-service teacher preparation programs. The effects of salary and sign-on bonuses comprise a discrete set of interventions potentially affecting teacher retention, but other interventions are more complex and multifaceted. This is the case, for example, with pre-service programs. Such programs include alternative licensure programs and pre-service training dedicated to preparing educators for the experience of teaching in high-need, high-poverty communities. Some research on the effectiveness of such programs in reducing teacher attrition has produced mixed results (Donaldson, 2009; Donaldson & Johnson, 2011; Jorissen, 2003).

One of these studies examined the Harvard Graduate School of Education Master's Degree Teacher Education Program (TEP), which began in 1984 (Donaldson, 2009). In 2001, the TEP transitioned from a traditional program to one with an urban focus. The urban-focused program included teaching practica in urban schools during the summer and school year. The program also included courses addressing issues in urban schooling and adolescent development in urban environments. The change from a traditional (pre -2001) to an urban-focused program provided the opportunity for a longitudinal study (1984 – 2006) on the effectiveness of each approach on the retention of its graduates.

The study of Harvard's Teacher Education Program sought to determine whether graduates of the urban-focused program showed a higher retention rate than graduates of the traditional TEP (Donaldson, 2009). In addition, the study was designed to determine the reasons graduates of each group left their teaching positions, if they did so during their first five years of employment.

A comparison of the retention results from Harvard's traditional TEP and its urban-focused program revealed that, among graduates of both programs who taught in urban schools, there was no significant difference in the likelihood that they would leave their teaching positions (Donaldson, 2009). However, graduates of the urban-focused TEP were more likely to teach in urban settings than their non-urban counterparts were. Although 63% of the respondents from the urban-focused cohorts reported teaching in a large urban school, less than 41% of the non-urban TEP respondents from the prior five years reported teaching in an urban setting. By contrast, 38% of the urban-focused program graduates reported teaching in a suburban school, while the majority (nearly 62%) of the traditional TEP graduates did so. Contrary to the goal of TEP program revision, when comparing the overall retention rate of the two TEP groups across all types of schools, the urban-focused program graduates demonstrated a higher attrition rate than the traditional TEP graduates.

Harvard TEP teachers' responses to survey questions about their reasons for leaving urban placements suggest that the quality of the urban-focused training program was responsible for the unchanged teacher attrition rate among urban teachers (Donaldson, 2009). Participants expressed that they did not feel adequately prepared for the challenges they ultimately faced in the urban school environment (Donaldson, 2009).

Similarly, the urban-focused teacher preparation program, Teach for America, has not produced improved teacher retention figures (Donaldson & Johnson, 2011). In fact, although Teach for America's beyond-two year retention rate had been 43.6%, after four years that number had dropped to 14.8% (Donaldson & Johnson, 2011).

In contrast to the disappointing results described for the Harvard Graduate School program and Teach for America (Donaldson, 2009; Donaldson & Johnson, 2011), another study

of teacher education programs has shown that training for high-need settings was associated with improved teacher retention (Kirchhoff & Lawrenz, 2011). In their study of Noyce scholars, Kirchhoff and Lawrenz (2011) used grounded theory research to discover the characteristics of teacher preparation that affected the careers of participants teaching in high-need schools. The Noyce Scholarship program, sponsored by the National Science Foundation, funds higher education institutions' programs designed to attract students to teaching in Science, Technology, Engineering and Mathematics (STEM) fields (Kirchhoff & Lawrenz, 2011). Noyce program graduates agree to teach in a high-need setting for a minimum of two years for each year of funding they receive.

This study of Noyce scholars (Kirchhoff & Lawrenz, 2011) revealed two key aspects of a teacher preparation program that seem to contribute to enhanced teacher retention. First, the programs provided field experiences for their participants related specifically to high-need settings. Effective experiences included student teaching, shorter field experiences, or coursework that focused specifically on urban teaching (Kirchhoff & Lawrenz, 2011). The cohort nature of the teacher education program also enhanced teacher retention. The support that participants received through their membership in a cohort increased the likelihood that they would remain in their teaching positions in high-need schools (Kirchhoff & Lawrenz, 2011).

Additional evidence suggests that specific characteristics of teacher education programs affect their success in promoting teacher retention in urban settings. Kirchhoff and Lorenz's (2011) findings that student teaching experiences and the cohort model for teacher training increase the rate of teacher retention in urban schools confirmed results suggested by an earlier study (Jorissen, 2003). In a qualitative study, Jorissen (2003) examined the effects of an integrated training program on teachers' experiences and retention in urban schools. The

program was an alternative certification approach designed to support career-changers' transition into teaching. In addition to pre-service coursework, the program included a full-year internship in an urban school, weekly evening meetings for the pre-service teachers to discuss and reflect on their internship experiences, and assigned mentors to work with the interns. Jorrissen (2003) interviewed six of the original program participants, all of whom were still working in urban schools six years after they had completed the program. Participants' feedback about this program demonstrated the strength of the mentorship experiences, the cohort model, and the integrated approach, which served to bridge the pre-service teachers' educational experiences to actual practice. Jorissen (2003) explains that over the course of the yearlong program, teachers progressed from personal concerns about their teaching to concern about students' outcomes. The author asserts that this transformation within a one-year period is advanced compared to a typical novice teacher (Jorissen, 2003).

Some studies have shown how pre-service programs may affect the retention of teachers through their influence on educators' commitment to teaching (LaTurner, 2002; Taylor & Frankenberg, 2009). Committed teachers are described as individuals who are willing to extend themselves beyond basic professional expectations (Taylor & Frankenberg, 2009); their commitment may extend to their school, their students, or their discipline (Firestone & Pennell, 1993).

In 2002, LaTurner highlighted the need for research investigating the relationship between the quality of pre-service programs and teachers' commitment to the profession. In 2009, Taylor and Frankenberg addressed this topic with respect to teacher preparation programs designed specifically for urban settings. They studied more than 200 individuals from four cohorts of a full time, graduate level program intended to prepare teachers for high-need settings.

The first phase of the three-phase program consisted of a period of team-teaching in an urban summer school with a mentor. The second phase included a semester of graduate level study along with pre-practicum experience in an urban school. Finally, the program concluded with a 12-week independent teaching experience of two classes in an urban school. Taylor and Frankenberg (2009) describe teachers' commitment to urban teaching as follows:

> We expect that this construct will reflect a specific type of professional commitment, indicating teacher candidates' specific dedication to working in schools in large central cities with high percentages of students of color and students from low-income families. Further, we believe that teachers' commitment to urban schools may be somewhat different than their commitment to teaching more generally. (Taylor & Frankenberg, 2009, p. 329)

The researchers measured teachers' levels of commitment at the end of each of the three phases of the program to assess changes in commitment over the course of the training program. They also compared teachers' commitment levels at the beginning and end of the program. The researchers asked the participants to rate their commitment to teaching, in general, and to urban teaching, specifically, using a scale of 1 – 10, with 1 indicating *no desire* and 10 indicating *a very strong desire* (Taylor and Frankenberg, 2009).

Taylor and Frankenberg's (2009) research showed that a pre-service urban-focused teacher education program (TEP) did not necessarily strengthen a teacher's commitment to teach in the urban environment. In fact, the results of their study showed that the average level of participants' commitment to urban teaching declined upon completion of the program.

In spite of this overall decline in commitment level, Taylor and Frankenberg's (2009) study was able to discern factors that correlated with urban-teaching commitment among the participants. For example, the researchers observed that an important predictor of a teacher's level of commitment to urban teaching at the end of the program was their early level of commitment (Taylor and Frankenberg, 2009). That is, teachers who reported higher levels of commitment to urban teaching early in the TEP reported higher levels of commitment to urban teaching at the program's end than did teacher's with lower levels of early commitment. The study also revealed that the nature of a prospective teacher's first field experience affected their level of commitment to teaching in an urban setting. In other words, teachers whose field experience occurred in a less-urban setting, reported lower levels of commitment to urban education at the end of the program than did participants whose teaching practicum experience was in a large city (Taylor and Frankenberg, 2009). Notwithstanding these correlations, the researchers reported that the most powerful positive predictor of a teacher's level of urban teaching commitment at the end of the program was the teachers' perception of the TEP's influence on their commitment to urban teaching (Taylor and Frankenberg, 2009).

Taylor and Frankenberg (2009) have also highlighted the value of urban-focused programs in helping some candidates recognize that the urban school setting may not be a good fit for them. In terms of teacher retention, this understanding on the part of teacher candidates might reduce some of the observed exodus of teachers from city schools within their first few years of service.

In spite of broad agreement about the need for urban-focused teacher preparation programs (Jorissen, 2003; Kirchhoff & Lawrenz, 2011; Taylor & Frankenberg, 2009) the limitations of existing urban TEPs have also been described. For example, Andrews and

Donaldson (2009) have identified four persistent problems of typical pre-service programs. The first of these problems deals with field experiences. Teacher education programs have generally struggled to include quality field experiences for participants throughout their programs. A second concern is the mismatch between the content of the training program and the reality of urban education. The gap between teachers' educational experiences and actual urban teaching limits the effectiveness of programs. A third problem described by Andrews and Donaldson (2009) is the lack of self-evaluation that is typical of teacher education programs. Without critical reflection, programs fail to strengthen their relevance to actual classroom teaching experiences. Finally, Andrews and Donaldson (2009) cite the problem of TEP courses taught in isolation of each other. Concepts addressed in different classes tend to remain isolated except for the fortuitous interconnections participants may make.

Andrews and Donaldson (2009) have suggested that teacher education programs need to embrace an interdisciplinary approach. That is, fields such as sociology and psychology must be integrated in the education of teachers if they are to be adequately prepared for teaching in the challenging urban school environment.

Induction/mentor programs. Once a teacher has secured a teaching position, efforts to support the new educator may take the form of an induction program that may include a mentor program. Induction programs in schools seek to assist beginning elementary and secondary teachers with their transition into teaching. Typically, these programs include orientation, assistance and support components for new teachers (Ingersoll & Kralik, 2004; Ingersoll & Smith, 2004). In general, these programs are distinct from pre-service training that a teacher would have completed prior to employment. Ingersoll and Smith (2004) have described them

succinctly, “These programs are often conceived as a bridge from student of teaching to teacher of students” (p. 29).

Induction programs vary considerably among schools (Ingersoll & Smith; 2004; Long, et al. 2012). For instance, programs may include one or more of the following components: regular supportive communication with the school principal, shared planning time with colleagues, an assigned mentor, and a reduced course load for new teachers (Ingersoll & Smith, 2004). Ultimately, the goal of induction programs is to enhance teacher effectiveness by improving teacher retention or by strengthening the skills of novice teachers. New teachers, who have experienced a quality induction program, have been shown to generate levels of student achievement comparable to students of a fourth-year teacher, who did not participate in an induction program (Alliance for Excellent Education, 2008).

Predictably, orientation or induction programs are not limited to the teaching profession. On the contrary, organizations and employers generally provide introductory training programs for new employees, and the education profession seems to have lagged behind other professions in this regard (Kelley, 2004). The format and content of private sector induction programs can be instructional for planning induction programs for public education. For example, in a program implemented in the University of San Diego for non-teaching staff, a four-part part model for employee induction was used (Santovec, 2010). The four key components of the program included assistive and informative communication before employment, a basic orientation program at the start of employment, opportunities for relevant training, and an ambassador program in which experienced, veteran employees assist novices. The ambassador program includes monthly meetings between the veteran and novice employees along with shared participation in recreational events (Santovec, 2010). The parallels between the ambassador

program and the mentor programs seen in schools are obvious. It is important to note, however, that the ambassador *buddy program* (Santovec, 2010) is focused on building relationships between employees. The importance of this characteristic for school mentor programs will be noted later.

The commitment of schools to assist in the transition of new teachers has become widespread in the last decade. In their review of literature on induction programs, Smith and Ingersoll (2004) observed that participation in teacher induction programs increased between 1990 and 2000, such that during the 1999-2000 school year, approximately 8 in 10 new teachers had participated in an induction program. Continuing this trend, 91% of new teachers reported having participated in an induction or mentor program by the 2007-2008 school year (Ingersoll, 2012).

The terms *induction program* and *mentor program* are often used interchangeably (Ingersoll & Smith, 2004). Notwithstanding the variation in definitions of these programs, there also seems to be a growing trend in teacher participation in mentor programs, specifically. For instance, during the 1999-2000 academic year, about 66% of teachers stated that they had worked closely with a mentor (Smith & Ingersoll, 2004), but by 2007-2008, this number had grown to 81% (Ingersoll, 2012).

Although the shared goal of mentor programs is to facilitate the assimilation of new teachers through the efforts of local, experienced colleagues, the specifics of mentor programs vary considerably (Ingersoll & Smith, 2004). For example, programs vary with respect to their duration, the level of prescribed teacher meetings and interactions, their primary focus, and the amount of training, if any, provided to the mentor teacher (Ingersoll & Smith, 2004). Similarly,

the features of induction programs vary among schools. These variations are revealed in data from the 2007-2008 school year. During that academic year, 87% of first-year teachers reported they had participated in meetings with administrators as part of their induction program, and 71% of first-year teachers that year had participated in induction seminars. However, only a little more than half, 58%, of beginning teachers were given planned opportunities for collaboration with colleagues, and 17% of first-year teachers that year received a reduced course load to help them acclimate to their new teaching positions (Ingersoll, 2012).

The variation in features of induction and mentor programs among schools suggests that their quality and effectiveness may differ among districts. In a description of Chicago's Community High School District 94 mentor program, Susan Brown (2003) identifies some features that may characterize programs that promote teacher retention. For example, the program includes regular meetings of mentors and opportunities for new teachers to provide feedback to their mentors as well as social activities for mentors and novice teachers. Other effective mentor programs include that of the Clark County Nevada school district, which employs a highly selective process of identifying mentors (Brown, 2003). Prospective mentors need a minimum of three years of experience along with demonstrated instructional and interpersonal skills. In addition, a screening committee comprised of teachers, principals, and representatives of the local teacher association must recommend prospective mentors. The program includes requirements for multiple observations by the mentor and monthly meetings and reflective logs by the participants. Interestingly, this mentor program had retained all of its novice (1 to 2-year) teachers over the two-year period prior to the article's publication (Brown, 2003).

Teacher retention has been strengthened through an induction program done in collaboration with higher education (Kelley, 2004). Colorado's longstanding Partners in Education (PIE) program has served between 10 and 30 novice teachers in up to six school districts annually since its inception in 1987. The induction program, which is one part of this collaborative initiative, emphasizes reflective teaching, weekly mentoring by expert teachers, frequent networking among new teachers, and a graduate education component tailored to meet the needs of individual participants (Kelley, 2004). The four-year retention rate of 94% for PIE program participants from 1987 - 1997 is noteworthy. Furthermore, most of these retained teachers remained in their original school districts (Kelley, 2004).

Efforts to identify the most effective characteristics of induction and mentor programs have generated a number of research studies (Ingersoll, 2012; Ingersoll & Kralik, 2004; Ingersoll & Smith, 2004; Kelley, 2004; Smith & Ingersoll, 2004). Ingersoll and Kralik (2004) examined 10 studies of induction programs and concluded that they provided empirical support for the positive effect of induction on teacher retention. However, they cautioned that there are limitations on the conclusions and generalizability of these studies because they addressed programs that differed in their content, program duration, and methods. Therefore, the authors recommended the following areas of additional inquiry: What are the characteristics of teachers who gain the most from mentoring programs? Which program components are the most effective? What are the effects of mentor selection and preparation? What is the optimum time for mentors and mentees to interact? What is the best duration for a mentor program? To what extent do mentor programs affect student achievement?

Studies have shed light on some of these questions. For instance, Smith and Ingersoll (2004) analyzed data from the 1999 to 2000 Schools and Staffing Survey (SASS) conducted by

the National Center for Education Statistics. Their analysis documented variations in induction programs, with program duration, for example, ranging from a single orientation meeting to a year-long program or longer. There was also variation in the background of the mentor, compared to that of the new teacher. Smith and Ingersoll (2004) have reported that the risk of a teacher leaving after one year was reduced by approximately 30%, if the teacher had been assigned a mentor from the same field of study. Improved retention was not statistically significant, however, for teachers who had been assigned a mentor outside of their academic field. Out-of-field mentors led to an 18% reduced risk of teacher turnover (Smith & Ingersoll, 2004). Interestingly, this study found that mentoring programs had no effect on the likelihood of teachers changing schools at the end of their first year.

Studies that are more recent also support the conclusion that induction and mentoring programs improve teacher retention (Ingersoll, 2012). Furthermore, the salient aspects of effective mentoring programs are becoming apparent through such research. By analyzing national data, Ingersoll (2012) has described important trends in the induction program movement. For example, studies have shown that induction programs that include several support components are more effective than those that incorporate fewer components (Ingersoll, 2012). Thus, a program that supplied two supports, such as a mentor and scheduled supportive meetings with an administrator, was less effective in retaining teachers that more comprehensive induction programs. A comprehensive program might include a reduced teaching schedule for new teachers, an ongoing supportive seminar, planning time with colleagues, in addition to the aforementioned supports of a mentor and regular communication with a supportive administrator (Ingersoll, 2012). The 2007 to 2008 data reviewed for Ingersoll's (2012) report show that only 5% of beginning teachers have received such a comprehensive induction package. However,

those who had participated in such a program showed an attrition rate that was less than half that of those who received no induction program (Ingersoll, 2012). Additionally, some induction program components were found to be especially effective in retaining teachers. In particular, the largest reduction in turnover rates was observed for teachers who were paired with a mentor in the same subject area and teachers who were assigned common planning time with other teachers in their subject area (Ingersoll, 2012).

Long and colleagues (2012) conducted a comprehensive literature review to discern the impact of induction and mentoring on the retention of novice teachers. The impetus for their research was a concern that induction and mentoring programs had become a widespread approach to addressing teacher retention problems without adequate attention to the research literature. Focusing on induction and mentoring literature connected to teacher retention or attrition, they reviewed 93 empirical studies, including both qualitative and quantitative research. Their comprehensive review, which documented the diversity of studies addressing induction/mentoring programs, raised questions and revealed gaps with respect to the effects of particular program characteristics on teacher retention. The authors offered the following insights:

> As we read the literature, we wondered if the most effective induction programs would involve engaging beginning teachers in collaborative, integrated cultures in schools that valued beginning teacher knowledge, that included them in the school programs and cultures as full members of the school community with attention to their stories of who they wanted to be and become as teachers. (Long, et al. 2012, pp. 19 - 20)

Although much of the preceding discussion illustrates the potential role of induction and mentoring programs in improving teacher retention (Ingersoll, 2012; Ingersoll & Kralik, 2004; Shockley et al., 2006; Smith & Ingersoll, 2004), some information raises questions about the strength of this connection because of the many factors that contribute to teacher retention and attrition (Long et al., 2012). Nevertheless, this discussion has revealed the strong correlation between the quality and comprehensiveness of induction and mentoring programs, and the degree of improved teacher retention they foster (Darling-Hammond, 2003; Ingersoll, 2012; Shockley et al., 2006; Smith & Ingersoll, 2004). The importance of the relationship between induction program quality and observed benefits has been described succinctly by Linda Darling-Hammond (2003), "Mentoring, and induction programs will only produce these benefits if they are well designed and well supported" (p.11). Additionally, in the case of mentor programs, the effectiveness of the collaboration depends upon having the “right fit” between the mentor and new teacher. Teachers have reported that the benefit they derived from their mentoring program was largely dependent on the mentor assigned to them (Andrews, Gilbert, & Martin, 2012). This observation aligns with the importance of relationships noted earlier in the discussion of the University of San Diego’s ambassador program for supporting new, non-teaching employees (Santovec, 2010).

Future empirical research that explores the characteristics of quality mentor relationships would add to the growing understanding of mentor programs' effectiveness (Ingersoll, 2012; Smith & Ingersoll, 2004). The value of additional induction program research is illustrated by the fact that such programs have been shown to improve teacher effectiveness as measured by enhanced student achievement (Ingersoll, 2012). Ingersoll (2012) asserts that since induction

programs can be costly, research is needed to identify which components of induction programs are the most cost-effective.

The complex and challenging nature of the teaching profession is beginning to be recognized (Ingersoll, 2012). Accordingly, the need to support new teachers in this demanding work is being acknowledged (Alliance for Excellent Education, 2008; Anhorn, 2008; Ingersoll, 2012). The Alliance for Excellent Education (2008) has captured the importance of supporting new teachers:

> …when combined with improved working conditions, comprehensive induction provides an environment of success for teachers - an environment that is crucial to equalizing the quality of education for all students. When teachers are not supported, the loss – to taxpayers, educators, schools, communities, and students – is immense. (p.7)

Professional community. The positive effects of a quality induction program correlate with another teacher retention factor that has emerged in the literature – the existence of a strong professional community in the school. There is considerable evidence that the professional culture of a school contributes to reducing teacher attrition (Baker & Keller, 2010; Certo & Fox, 2002; Ingersoll, 2011; Loeb, Darling-Hammond, & Luczak, 2005; Martinez, Frick, Kim & Fried, 2010).

Johnson and Kardos (2002) discuss the importance of an *integrated professional culture* in promoting teacher retention. This type of professional culture can exist when there is a balance of veteran and novice teachers who exchange insights and expertise. By contrast, a *veteran-oriented professional culture* can arise in schools or departments consisting primarily of teachers with many years' experience (Johnson & Kardos, 2002). In such environments, novices

might feel isolated and intimidated to ask for support from colleagues who are predominantly established, veteran teachers. New teachers can also fail to receive sufficient support in *novice-oriented professional cultures*, in schools or departments comprised of mainly new, inexperienced teachers (Johnson & Kardos, 2002). Johnson and Kardos (2002) describe situations in which they observed *novice-oriented professional cultures*:

> These school sites generally included two types of schools: start-up charter schools staffed largely with new recruits, many of whom had no formal preparation as teachers, and urban schools that were poorly organized or in disrepair and, thus, repeatedly experienced high turnover as teachers left for better work settings. In these schools, with so many new teachers, there existed an abundance of energy and vigorous commitment – but little professional guidance about how to teach. (p.15)

In a study investigating teacher retention and attrition in seven Virginia school divisions representing urban, rural and suburban settings, Certo and Fox (2002) identified three main reasons that teachers gave for staying in their teaching positions. Teachers named commitment to teaching, quality administration, and relationships with colleagues as the main reasons for their retention. More specifically, their collegial interactions involved planning lessons, collaborating on instructional strategies and materials, and discussing student work. The theme of strong professional culture again appears in this example as a job satisfier for educators.

In a longitudinal study that focused on the role of professional culture in promoting teacher retention, Johnson and Birkeland (2003), interviewed a diverse sample of 50 public school teachers in Massachusetts in 1999 and again in 2001during the teachers' first or second year of teaching. Their study examined teachers' views regarding a teaching career as well as the way they experienced their work in schools. By conducting 3-year follow-up surveys, they

sought to determine how the teachers' experiences and the conditions in their school settings affected their plans and career decisions.

Johnson and Birkeland's (2003) work revealed an unmistakable influence of professional culture on teachers' decisions to leave or remain in their positions. A lack of collaboration and support from colleagues influenced teachers' decisions to leave a particular school (Johnson & Birkeland, 2003). Teachers explained that working conditions contributed to their lack of efficacy. The researchers concluded that teachers' efficacy in the classroom was a critical factor in their decisions to stay or leave their teaching positions. In other words, teachers who believed they were effective in teaching their students were inclined to stay, but teachers who felt they were not being successful were likely to leave teaching completely or move to another school or district (Johnson & Birkeland, 2003). Of particular importance to the current discussion, however, are the teachers' explanations of the working conditions that contributed to their lack of efficacy. Teachers who left their positions often complained of an inadequate collegial support system. The lack of collaboration and support from colleagues contributed to their decisions to leave a particular school (Johnson & Birkeland, 2003). Furthermore, studies have shown that positive collegial relationships can enhance teacher retention (Anhorn, 2008; Johnson & Birkeland, 2003). While one teacher might choose not to return to a teaching position because of poor relationships with colleagues, other teachers have been found to return to their positions because of positive, supportive relationships (Anhorn, 2008). New teachers value opportunities to learn from their colleagues through collaboration (Andrews et al., 2012; Smith & Ingersoll, 2004).

The beneficial effects of a strong professional culture were evident in a study of retired teachers serving as urban classroom volunteers in a program known as Experience Corps

(Martinez et al., 2010). The volunteer retirees served as mentors and provided Baltimore teachers with opportunities for collaboration, problem solving, and stress reduction, thus enhancing the work environment for them (Martinez et al., 2010). The results of this study showed positive influences on classroom environment, teacher effort, and teacher satisfaction as well as a reduction in teacher absenteeism. The authors propose that the retired teacher volunteers enhanced factors that contribute to improved teacher retention and reduced attrition. Environments characterized by teacher collaboration, idea exchange, and mutual support strengthen professional culture.

Others have strengthened school culture through the support of non-teaching as well as teaching professionals. For example, Baker and Keller (2010) describe the success of the Science Teacher and Researcher (STAR) Program designed for pre-service and new Science, Technology, Engineering, and Mathematics (STEM) teachers. The authors point to the networking provided by the STAR program as the source of its success. In this program, which included 156 participants from 2007 – 2010, participants interact with scientists as well as mentors, other STEM teachers, and their peers. In fact, the participants have cited these relationships as the most significant aspect of the program. During the summer, STAR teachers complete an eight-to-ten-week laboratory research internship that includes intermittent education seminars and workshops. Following the summer experience, weekly seminars are conducted throughout the school year to promote infusion of the summer learning into classroom teaching. An online resource tool provides additional networking opportunities. Often new science teachers point to the isolation of teachers from the scientific community as one of the reasons for leaving the profession (Baker & Keller, 2010). Although the actual effect of the STAR program on science teacher retention was not studied, the feedback teachers provided about their reactions

to the STAR program suggest positive effects. For example, an evaluation report prepared in the summer of 2009 using feedback from that year's 39 participants revealed that 89% of the participating teachers believed their confidence and interest in teaching had improved. Eighty-nine percent also felt that the program led them to feel a greater sense of professional prestige. One hundred percent of the STAR program participants that year stated that the program made them feel a part of a larger community of teacher-researchers (Baker & Keller, 2010).

The strength of professional culture and teacher collaboration as vital supports for beginning teachers may be most evident in the recommendations by Johnson and Birkeland (2003). These authors suggest that schools rely less on one-on-one mentoring, and focus their efforts instead on building structures that promote school-wide professional cultures. Beginning teachers need collegial collaboration as they negotiate the intricacies of a new teaching career. This need, however, is in stark contrast to the tendency of teaching to be an isolating experience (Andrews et al., 2012; Anhorn, 2008; Johnson & Birkeland, 2003). New teachers have emphasized their need for non-evaluative feedback (Andrews et al., 2012), and their professional colleagues are potential sources of such input.

By way of summary, the retention factors discussed thus far affect individual teachers directly. For instance, salary and sign-on bonuses (Clotfelter et al., 2008; Donaldson & Johnson, 2011) affect a teacher's personal life and, therefore, can influence a teacher's job satisfaction. Pre-service and in-service education experiences (Andrews & Donaldson, 2009; Brown, 2003; Donaldson, 2009; Donaldson & Johnson, 2011; Jorissen, 2012; Kirchhoff & Lawrenz, 2011; Taylor & Frankenberg, 2009), as well as relationships with professional colleagues (Andrews et al., 2012; Anhorn, 2008; Baker & Keller, 2010; Certo & Fox, 2002; Johnson & Birkeland, 2003; Martinez et al., 2010), also affect teachers directly. Nevertheless, a closer look at school

organizational factors reveals that the opportunities for collegial collaboration and in-service professional development are largely under the control of school and district leadership (Johnson & Birkeland, 2003). Interestingly, research has demonstrated that district and school leadership (Angelle, 2006; Andrews, et al. 2012; Certo & Fox, 2002; Ingersoll, 2001; Ingersoll, 2011; Ladd, 2011; Stevenson, Dantley, & Holcomb, 1999), a factor that may seem indirectly connected to the daily life of individual teachers, contributes significantly to teacher retention. In the next section, the role of school leaders in fostering new teacher success and retention will be examined.

Leadership. In urban settings, in particular, teachers face instructional challenges associated with racial and ethnic diversity as well as low socioeconomic conditions (Andrews & Donaldson, 2009). These challenges increase stress upon novice educators that can contribute to increased attrition. District and school leadership, however, can provide support to teachers and reduce these stressors thereby decreasing the attrition of qualified educators (Certo & Fox, 2002; Johnson & Birkeland, 2003). For example, researchers have highlighted the value of principals adopting the role of mentor and supporting the socialization of new teachers into the school organization (Angelle, 2006; Tillman, 2005). In urban settings, in particular, a principal's active involvement in the mentoring of novice teachers can strengthen the teachers' skills and effectiveness thereby promoting increased retention (Tillman, 2005).

Helen F. Ladd (2011) analyzed data collected by the state of North Carolina regarding teachers' perceptions of their working conditions in an effort to assess the impact of their perceptions on their intended departure from school assignments. School leadership emerged as the most important factor influencing a teacher's intention to leave a position. Correspondingly, in their study of Teach for America teachers, Donaldson and Johnson (2011) observed that

nearly one tenth of teachers who left their positions indicated that their decision was based upon poor administrative leadership in their schools. This finding is consistent with Ingersoll's (2001, 2011) work regarding teacher turnover in urban schools. Through an analysis of 20 years of data from US Department of Education surveys, Ingersoll identified specific working conditions in schools that are associated with high turnover rates. These conditions included student behavioral problems, the amount of professional autonomy, the quality of professional development as well as the quality of school leadership.

Similarly, Certo and Fox (2002) interviewed teachers who had left schools or the profession in a sample from seven school divisions in Virginia. They determined that a lack of school-level administrative support was the most reported reason for a teacher leaving. Conversely, teachers who remained in their positions cited administrative support as one of the reasons they stayed. Certo and Fox (2002) have defined administrative support, based on teachers' comments, in this way, ". . . policies or practices present that supported teacher work and created an environment that treated teachers as professionals" (p.6). This explanation illustrates teachers' perceptions of school leadership support and professional culture as interconnected and highly important aspects of their work environment.

Research has shown that communication between school leaders and beginning teachers is important, in terms of both its quality and its frequency (Andrews et al., 2012; Ingersoll, 2012; Smith & Ingersoll, 2004). Because new teachers have much to learn in their new roles, they seek non-evaluative feedback from their colleagues and their supervisors to help them grow and become successful (Andrews et al., 2012; Smith & Ingersoll, 2004). Studies comparing the perceptions of teachers and principals regarding factors that affect teacher retention (Andrews et al., 2012; Stevenson et al., 1999) have revealed noteworthy differences. Stevenson and

colleagues (1999) observed, for example, that school leaders ranked mathematics and science teachers' reasons for leaving the profession differently than research-reported rankings by teachers themselves. Andrews, Gilbert, and Martin (2012) examined teachers' perceptions of support-received with administrators' perceptions of support-provided and uncovered differences in their perceptions. For instance, although school leaders might believe that teachers are being given the opportunity to collaborate with their colleagues, teachers may report that they are not receiving that support because their schedules do not allow them to actually meet with their colleagues (Andrews et al., 2012). Although the authors caution that this study, which involved participants from 14 school districts, did not provide for an exact match between the teachers and administrators, the results suggest disparities in perceptions between leaders and teachers. Such disparities might reflect differences between planned teacher supports and their actual implementation. The results of these studies (Andrews et al., 2012; Stevenson et al., 1999) suggest the need for improved communication between school leaders and new teachers.

Andrews and colleagues' (2012) study underscores what Johnson and Birkeland (2003) have described as principals' key role in promoting teacher collaboration. Johnson and Birkeland (2003) recommend a commitment to scheduled dialogue between teachers and school leaders, an intervention that would potentially address the disparity in teacher and administrator perceptions. They also suggest additional research to examine how administrators can best support teachers and to determine ways to assess the effectiveness of administration in providing that support. Additionally, Johnson and Birkeland (2003) recommend that studies strive to identify the training administrators may need to foster improved dialogue. Studies that are more recent suggest that non-evaluative observations that provide supportive feedback for new teachers

would strengthen the communication and sense of support between administrators and teachers (Andrews et al., 2012).

In addition to their need for regular non-evaluative feedback on their classroom teaching, teachers have described other needs that school administrators may address. For example, teachers have explained the importance of administrators' graduated expectations for their improvement (Johnson & Birkeland, 2003). Decision-making, has also emerged as a factor affecting teacher retention. New teachers value the administrative support that is shown when a school leader welcomes their input (Andrews et al., 2012). Marianne Dove (2004) has highlighted the effects of accountability efforts on teachers' perception of their working conditions. Central to teachers' concerns is the practice of using student performance on tests to assess teachers' effectiveness. Dove (2004) has reported that teachers feel this practice of evaluating teachers has reduced their input into instructional and curricular decision-making.

As is true for professional collaboration and collegiality, school leadership can serve to enhance teacher retention or exacerbate attrition. In their study of 50 teachers in Massachusetts, Johnson and Birkeland (2003) conducted interviews as teachers began their careers and again three years later. Their goal was to discover factors and school conditions that affected the career decisions of the teachers in their diverse sample. Among their significant findings was the role of school leadership in affecting career decisions of new teachers. Johnson and Birkeland (2003) described, for example, the decisions of teachers who chose to leave the profession entirely or to relocate to new schools. Eleven of the original teachers were designated as *leavers* because they left the teaching profession entirely, and more than half of them did so after their first year of teaching. Eleven other teachers were categorized as *movers* because follow-up interviews revealed that they had moved to other schools and/or school districts after 3 years. Of the

teachers who moved locations, two did so because teachers that were more senior bumped them from their positions, while another obtained a position at a different school following contract nonrenewal. Interviews revealed that the decisions of both *leavers* and *movers* were informed by characteristics of school leadership and the professional culture. Unsupportive leaders and isolating environments influenced teachers' decisions to leave their positions (Johnson & Birkeland, 2003).

Twenty-eight teachers in this study remained in their positions over the three-year period (Johnson & Birkeland, 2003). Fifteen of these teachers, referred to as *stayers*, expressed dissatisfaction with their experiences in spite of staying, and were designated, *unsettled stayers*. The dissatisfaction they expressed stemmed from working conditions, including heavy workloads, schools' lack of effort to involve parents, and inadequate curricular resources. Similar to the voluntary *movers* and *leavers*, the *unsettled stayers* also cited intimidating or ineffective principals and unsupportive colleagues as reasons for their dissatisfaction.

The *settled stayers*, on the other hand, expressed confidence and competence in their positions (Johnson & Birkeland, 2003). The *settled stayers* were the 13 teachers who remained in their positions, and expressed satisfaction in them, at the end of the three-year study period. They described school environments that were supportive and nurturing. They explained that their principals understood that the new teachers were on a path of continuous improvement. They also stated that their fellow teachers urged them to set reasonable goals for themselves. Johnson and Birkeland (2003) affirmed the generalizability of their study's findings by noting that many of these *settled stayers* were working in diverse schools, including schools that serve populations of low socioeconomic means and high racial and ethnic diversity. The reflections of the *settled stayers* also revealed that their school environments were orderly and safe, with clear

expectations for students. In this regard, school leaders exert additional influence on teacher retention as they foster such school environments.

Thus far, this review has focused on the role of school leadership in promoting the retention of teachers. Certo and Fox (2002) also identified district level leadership as a factor affecting teacher attrition. "Top – down" leadership contributed to teachers' dissatisfaction in their positions as did professional development activities unmatched to their needs and their perceived lack of involvement in decision-making. Teachers also cited excessive "last-minute" paperwork and meetings as problematic. Thus, in this study the factors teachers identified as affecting retention are suggestive of isolation and poor communication between district and school leadership and classroom educators.

Others have also identified retention factors that may reflect district and school leadership concerns. These factors include poor working conditions (Loeb et al., 2005), inadequate facilities (National Research Council, 1992), insufficient planning time (Certo & Fox, 2002), and poor student behavior (National Research Council, 1992). Undoubtedly, other issues, such as school funding, may contribute significantly to some of these conditions. Nevertheless, school or district leadership is likely to have some influence upon each of them.

Table 2.1 summarizes the teacher retention factors that have been discussed (monetary compensation, pre-service programs, induction programs, professional culture, and leadership) and the studies that have addressed them.

Table 2.1

Factors Potentially Affecting Teacher Retention in Urban Schools

FACTOR	AUTHOR(S)	DATE OF STUDY	EFFECTS OBSERVED
Monetary Compensation: Teach for America's Transition Funding Package	Donaldson & Johnson	2011	Did not promote retention
Monetary Compensation: $1800 Annual bonus	Clotfelter, et al.	2008	One sixth reduction in turnover rates
Pre-service programs: Harvard Graduate TEP (urban-focused)	Donaldson	2009	Did not promote retention
Pre-service programs: Teach for America (urban-focused)	Donaldson & Johnson	2011	Did not promote retention
Pre-service programs: Noyce Scholarship Program (high-need settings)	Kirchhoff & Lawrenz	2011	Improved retention
Pre-service program: Integrated Training Program	Jorissen	2003	Shift in teacher concern from self (teaching) to student outcomes
Pre-service program: Full time graduate program – Early urban field experience	Taylor & Frankenberg	2009	Increased commitment to teaching in urban setting
Induction programs: mentor program	Brown	2003	Promoted retention of 1 and 2 year educators
Induction programs: Partners in Education	Kelley	2004	Improved retention
Induction programs: SASS mentor program data from 1999-2000	Smith & Ingersoll	2004	Reduced risk of attrition, especially with in-field mentor
Induction programs: Review of data through 2008	Ingersoll	2012	Strength of improved retention rate depended on number of supports
Induction programs: Review of 10 studies	Ingersoll & Kralik	2004	Confirmed improved retention but with limited generalizability; suggested new areas of study

Table 2.1 (continued)

FACTOR	AUTHOR(S)	DATE OF STUDY	EFFECTS OBSERVED
Induction programs: Analysis of 1999-2000 SASS data	Smith & Ingersoll	2004	Documented relationship between induction program characteristics and level of improved retention
Induction programs: Literature review	Long et al.	2012	Raised questions about efficacy of some induction/mentor program components
Professional community: STAR program	Baker & Keller	2010	Improved confidence and interest in teaching; enhanced sense of professional status
Professional community: Virginia schools	Certo and Fox	2002	Enhanced retention
Professional community: Retired teacher volunteers	Martinez et al.	2010	Improved collaboration, reduced teacher stress, enhanced problem-solving
Professional community: Collegial support	Johnson & Birkeland	2003	Lack of collegial support contributed to reduced teacher efficacy and decisions to leave; Strong support correlated with decisions to stay
School leadership: Problems	Ladd	2011	Contributed to decisions leading to attrition
	Donaldson & Johnson	2011	Contributed to the decisions of 1/10 of teachers who left
	Ingersoll	2011 & 2001	Increased attrition
	Johnson & Birkeland	2003	Increased attrition and relocation to other schools
	Certo & Fox	2002	Increased attrition

Table 2.1 (continued)

FACTOR	AUTHOR(S)	DATE OF STUDY	EFFECTS OBSERVED
School leadership: Supportive	Angelle	2006	Socialization into effective schools enhances teachers' intent to stay
	Tillman	2005	Strengthened teacher's perception of success
	Johnson & Birkeland	2003	Fostered teacher retention
School leadership: Communication	Andrews et al.	2012	Differing perceptions of support between teachers and principals
	Stevenson et al.	1999	Differences in ranking of teacher attrition factors
School leadership: Poor working conditions, including:	Ingersoll	2011 & 2001	
-Student behavior problems	Loeb et al.	2005	Increased teacher dissatisfaction and/or increased attrition
-Poor facilities	Certo & Fox	2002	
-Insufficient planning time	National Research Council	1992	
Professional climate: lack of teacher autonomy	Ingersoll	2011 & 2001	Increased attrition
Professional climate: poor quality of professional development	Ingersoll	2011 & 2001	Increased attrition
District leadership – "top-down" style	Certo & Fox	2002	Increased teacher dissatisfaction

Significance of the Teacher Retention Problem

Statistical evidence of a teacher retention problem in American schools is compelling. In the 2004-05 Teacher Follow-up Survey (Marvel et al., 2007) conducted by the National Center for Education Statistics, a trend of increasing teacher turnover is apparent between 1988 and 2005, the time of publication. During the 1988-89 school year, 13.5% of teachers changed schools or left the profession after one year teaching, and each subsequent year saw an increase in teacher turnover, with the percentage climbing to 16.5% during the 2004-05 school year (Marvel et al., 2007).

The continued research emphasis on teacher retention is significant, but it is not without some debate. For example, some have questioned the practice of including in teacher turnover figures both teachers who move from one education position to another and teachers who leave the profession (Colgan, 2004). Others have defended turnover rates as ways of eliminating ineffective teachers. Still others contrast public and private school turnover rates, stating that attrition rates are actually higher in private schools than in public schools (Colgan, 2004). Nevertheless, the preponderance of education literature identifies the retention of teachers as an important factor affecting teacher quality and instructional quality as well as fiscal demands for schools and districts (Donaldson, 2009; Ingersoll, 2001; Watlington et al., 2010).

The loss of qualified new teachers has potentially devastating effects on school culture and instructional quality (Darling-Hammond, 2003). When educators and students witness a "revolving door" of teachers in their school, their perception of their school is likely to decline. In the following section, the costs associated with teacher turnover will be described.

Costs of Teacher Attrition

Monetary costs. The impacts of teacher turnover on education in America include economic consequences for districts and schools. When qualified teachers leave their positions, schools encounter costs from a variety of sources. For example, there are the costs associated with the exit of the teacher: the lost funds that were associated with induction services provided to that teacher, professional development costs, and the costs of recruiting and hiring a replacement for that educator, among other factors (Barnes, Crowe, & Schaefer, 2007). The National Commission on Teaching and America's Future (NCTAF) (2007) has estimated that the annual cost of teacher turnover in American schools could be greater than $7.3 billion annually, "NCTAF's findings are a clear indication that America's teacher dropout problem is spiraling out of control. Teacher attrition has grown by 50 percent over the past fifteen years" (National Commission on Teaching and America's Future, 2007, p.1).

Recently, the striking monetary costs associated with new teacher attrition have become known (McKinney et al., 2007; Shockley et al., 2006; Watlington et al., 2010). Unsurprisingly, research has shown that the cost to replace teachers varies by district (Alliance for Excellent Education, 2008). The National Commission on Teaching and America's Future has estimated that the annual cost to address teacher transfers in urban schools is $70,000, while nonurban schools spent less than half that amount, $33,000 (Alliance for Excellent Education, 2008).

In a study designed to reveal the financial costs of teacher attrition, Shockley and colleagues (2006) revealed an inverse relationship between the cost of teacher replacement, and teacher turnover rate. Based upon budget data from the 2004 – 2005 academic year, the authors calculated teacher replacement costs for two large school districts in Florida. Broward County School District is a school district that serves 270,000 students and is the fifth largest district in

America. With 238 member schools, it serves a culturally and ethnically diverse population of students, K-12. Sixty percent of its students belong to minority populations, and the primary language of about 11% of students is not English. The data analyzed for the Broward County school district revealed a teacher replacement cost of $12,652. The district's turnover rate was 7.25%.

The other school district examined in this study (Shockley et al., 2006) was the St. Lucie County School District, a system significantly smaller than the Broward County School District. St. Lucie County served about 30,000 students in 40 public schools. Approximately 40% of these students were minorities, and 6% had a primary language other than English. For the St. Lucie County school district, teacher replacement costs were found to be $4631 per teacher, and the district's turnover rate was 16.4% (Shockley et al., 2006).

Upon first review, the inverse relationship between replacement costs and turnover rates observed in these two districts seems puzzling. However, the authors identify a correlation between the induction programs in each school district and their teacher turnover rates (Shockley et al., 2006). Their analysis reveals that the district with the lower teacher turnover rate, that is, the Broward County school district, had invested considerably in its teacher induction program, called the New Educator Support System (NESS). This district's financial investment in its new teacher support program, contributed to its higher teacher replacement cost. Correlated with this expenditure and commitment to support and retain teachers, however, was a teacher turnover rate that was less than half that of the St. Lucie school district. The lower turnover rate, in turn, reduced overall expenditures by the Broward County school district (Shockley et al., 2006). This analysis highlights the cost–effectiveness of teacher induction and mentoring programs (Shockley et al., 2006).

Non-monetary teacher turnover costs. The non-monetary costs of teacher turnover are necessarily more difficult to quantify, yet they are significant. Such costs may include reduced morale and productivity (Finnegan, 2010). Although the effects of turnover on teacher morale and professional culture have not been widely examined, other negative effects have been described. For example, the disruptive influence of teacher turnover on the establishment and continuity of programs and policies introduced by school principals has been noted (McKinney et al., 2007). Studies have also examined the detrimental effects on instructional quality and student achievement (Alliance for Excellent Education, 2008; Darling-Hammond, 2003; McKinney et al., 2007).

Understanding the connection between teacher experience and classroom instruction is fundamental to comprehending the effects of teacher turnover on student achievement. Classroom experience contributes to new teachers' growth in effectiveness. Few would argue that a teacher's effectiveness in the classroom is strongest during their first year of teaching. Given the diverse and challenging tasks associated with teaching, it is understandable that a teacher's first year includes adjustments to the profession and to the daily demands of the job. The most significant improvement in teachers' effectiveness occurs between their first and second years of teaching, and additional gains occur between their second and third years (National Council on Teacher Quality, 2009). Thus, by their fifth year, teachers have generally reached their peak level of effectiveness.

Some researchers have raised concerns that the reported improved effectiveness of teachers during their early years may be artificially inflated in some studies (Henry, Fortner, & Bastian, 2012). Henry and colleagues (2012) chose to determine if the significant increase in teacher effectiveness in the first few years of teaching might be a result of the method of data

analysis used in such studies. Henry et al (2012) suggest that the higher exit rate of less effective teachers may inflate the apparent increasing effectiveness of those that remain. To address this question, Henry and colleagues (2012) investigated the effectiveness and attrition of a large sample of new mathematics and science teachers in North Carolina. The sample for their study matched 7961 teachers with their 624,842 students. Teacher effectiveness was measured by students' performance on end-of-course tests. A significant finding of this study supported the conclusion of earlier studies that a teacher's effectiveness improves dramatically within the first few years of experience. It also revealed that the gains in teacher effectiveness decrease after the fourth year of teaching (Henry et al., 2012).

The importance of Henry and colleagues' (2012) findings is especially apparent when the negative effects of teacher attrition are considered. When new teachers leave positions within their first few years of teaching, the schools they leave lose employees who have made their most significant gains in effectiveness. Additionally, the new teachers who replace them are likely to begin at a comparatively lower level of teaching effectiveness. The resulting negative consequences for student achievement associated with this teacher exodus are readily apparent.

Henry and colleagues (2012) also observed differences in the rate and degree of improved teaching effectiveness among teachers of different mathematics and science courses. In particular, of the Science, Technology, Engineering and Math (STEM) subjects studied, physics, chemistry, and geometry showed the greatest improvement in teacher effectiveness during the first four years of teaching. Consequently, these subjects are likely to endure the greatest losses in teacher effectiveness and student achievement when teachers leave their positions within the first five years of their employment. It is also noteworthy, that even though biology, physical science, and algebra 2 did not show the same degree of improved teacher

effectiveness during the early years of employment as did physics, chemistry, and geometry, these subjects showed greater increases in teacher effectiveness than did non-STEM subjects (Henry et al., 2012). The authors conclude, "Our results show that increased reliance on novice teachers leads to lower average teacher effectiveness" (p.1121).

The overwhelming conclusion of research on teacher effectiveness is that when schools lose new teachers within their first five years of employment, they experience great losses. Teachers who have honed their skills during their early years of employment take those skills with them if they transfer to other schools or leave the teaching profession.

When the negative effects of teacher turnover on student achievement are considered in combination with economic consequences, the costs are alarming. The National Commission on Teaching and America's Future (2007) has spotlighted the problem effectively:

> Until we recognize that we have a retention problem we will continue to engage in a costly annual recruitment and hiring cycle, pouring more and more teachers into our nation's classrooms only to lose them at a faster and faster rate. This will continue to drain our public tax dollars, it will undermine teaching quality, and it will most certainly hinder our ability to close student achievement gaps. (p. 1)

Considerable efforts have been made in schools to improve instruction in America, and much has been written about these efforts. While the importance of these efforts is undisputed, the contribution of teacher turnover to student achievement problems in our schools warrants additional attention and study. Differential effects among STEM and non-STEM courses suggest particular areas of concern in schools. Similarly, differences in the socioeconomic characteristics of schools must be considered when evaluating the costs of teacher attrition.

Teacher attrition in urban schools. The negative effects of teacher attrition on student achievement are of even greater concern when we consider that the schools most affected by high teacher attrition are those serving at-risk children (Brown, 2003; Donaldson & Johnson, 2011). Data published by the National Center for Education Statistics (Marvel et al., 2007) illustrate the lower retention rate of urban districts. After one year of teaching in urban schools (referred to as *central city* schools), 20.2% of teachers either moved to another school or left the teaching profession. By comparison, non-urban schools realized a loss of 15% to 15.2%. Urban schools, therefore, are facing a greater challenge in retaining quality teachers than are their suburban and small town counterparts. Although inexperience does not necessarily mean that a teacher will be ineffective, the data on the retention of highly qualified teachers are disturbing. An early publication of the National Research Council (1992) concentrated on teacher supply, but the report also addressed the issue of teacher attrition. In particular, the study cited poor student discipline, poor facilities, large class sizes, and excessive administrative supervision as engendering teacher attrition. Equally important was the finding that teachers with the highest credentials had higher rates of attrition (National Research Council, 1992). Undoubtedly, academic credentials alone do not guarantee effective teaching skills; nevertheless, the high rate of turnover of such highly credentialed educators raises concerns.

Teacher attrition in urban school districts creates financial as well as academic challenges that are of particular concern. Schools in high-need settings are required to use human and financial resources to replace teachers. Furthermore, they must devote additional resources to identify, hire, support, and develop new teachers to replace them (National Commission on Teaching and America's Future (NCTAF), 2007). The negative reinforcement of this situation is all too clear. High-need schools experience a continuous strain on their resources and struggle to

meet the needs of their inexperienced teachers. Frustrated, discouraged, and overwhelmed, many of the novice teachers leave their positions (NCTAF, 2007). The cyclic nature of the teacher turnover problem means that high-need schools repeatedly face the challenge of teacher replacement, and their students continue to receive instruction from inexperienced and under-supported educators.

A pilot study commissioned by the NCTAF has confirmed the urgency of the issue of teacher retention in high need schools (Barnes et al., 2007). The study focused on five school districts representing a variety of socioeconomic conditions. These districts were sampled from Illinois (Chicago), Wisconsin (Milwaukee), North Carolina (Granville), and New Mexico (Jemez Valley and Santa Rosa). The study's findings illustrate the disproportionate effects of teacher turnover on high-need districts. For example, the study identified a correlation between high teacher turnover and low student achievement and high poverty in both Chicago and Milwaukee. The study also documented the drain on school financial resources incurred by schools with at-risk student populations. Furthermore, because funds were scarce in these districts, the dollars spent on teacher replacement necessarily reduced funds available to support professional development or instruction (Barnes et al., 2007).

The Broader Context of Employee Retention

The education literature on teacher retention offers several areas of intervention to address attrition issues. However, the broader context of employee retention sheds light on some fundamental issues of working conditions and employee relationships that education literature has not addressed specifically. By looking outside of the field of education, subtleties can be identified that may potentially enhance teacher retention efforts. In particular, a deeper

understanding of workplace environments and human needs within those environments can inform programs that seek to reduce teacher attrition.

Relational trust. In *The Five Dysfunctions of a Team*, Patrick Lencioni (2002) uses a leadership fable to acquaint the reader with essential components of an effective team. Lencioni tells the story of a new leader who molds her team into a highly effective and highly productive unit. It becomes apparent to the reader early in the narrative, that interpersonal trust is foundational to this transformation. Simultaneously, however, it also becomes obvious that relational trust is uncommon in the workplace and, perhaps more importantly, very difficult to establish and maintain in a workplace team. The difficulty in creating a foundation of relational trust stems from common practice and shared experience. Because pervasive trust among employees and supervisors has not been the experience of most, the approaches to creating a climate based on trust seem foreign, awkward, and uncomfortable.

Lencioni (2002) defines trust in this way, "In the context of building a team, trust is the confidence among team members that their peers' intentions are good, and that there is no reason to be protective or careful around the group. In essence, teammates must get comfortable being vulnerable with one another" (p. 195). He also explains the reasons for our discomfort with establishing such an environment:

> Achieving vulnerability-based trust is difficult because in the course of career advancement and education, most successful people learn to be competitive with their peers, and protective of their reputations. It is a challenge for them to turn those instincts off for the good of a team, but that is exactly what is required. (Lencioni, 2002, p. 196)

The theme of relational trust is integral to Richard Finnegan's (2010) plan for retaining workers. *Rethinking Retention in Good times and Bad* (Finnegan, 2010) presents an approach useful to public and private organizations to retain their valued employees. While Finnegan's plan is broadly applicable, he also briefly makes the connection to educational settings, specifically. He quotes a National Education Association spokesperson, " 'Teachers will move to or remain in schools with strong administrative leadership. One board-certified teacher in North Carolina who taught in a high-needs school said,' 'I would follow my principal to a shed to teach' " (p.104).

Finnegan (2010) spotlights the primary role of relational trust in fostering employee retention. He asserts that supervisors need to create the workplace conditions that cause good workers to remain with the organization. Finnegan (2010) frames his discussion of these needs, using Maslow's theory (Maslow, 1943). In particular, he examines the three needs that form the middle of Maslow's hierarchy: the need for safety, social needs, and the need for esteem. The overarching message Finnegan (2010) highlights is "Relationships are based primarily on trust and self-esteem. You stay with people who look out for you and who make you feel good about being you" (p. 105).

In order to apply these concepts to the workplace, Finnegan (2010) offers several guidelines to supervisors. His suggestions, which exemplify attention to Maslow's hierarchy of needs, deliver these messages:

- "My supervisor likes me and believes in me" (p.105).
- "My supervisor sets aside time just for me and believes my opinions are important. I feel really connected to her" (p.106).

- “The people I work with care about me, so I really enjoy going to work” (p.106).
- “My supervisor knows me – what I like and what I'm good at – and keeps coaching me on ways to do better and learn more. I can keep growing here” (p.107).
- “I know what to do and I know it's important. We do great things here” (p.107).
- “I feel great when I leave work because I know that I've done something good. My job makes my life better” (p.108).

The importance of relationships, Maslow's (1943) social or "belongingness" needs, is also evident in Santovec's (2010) description of the University of San Diego's First Year Employee Experience (FYEE) program. This program, designed for nonteaching employees, strives to facilitate new workers’ transition into their positions. It emphasizes the formation of relationships for new employees so that they quickly see themselves as members of their team of coworkers. The author notes that females, in particular, prioritize relationships. Their productivity is negatively affected if they do not feel welcome and connected to coworkers because of the unhappiness they experience (Santovec, 2010). The FYEE program, therefore, strives to begin the formation of relationships with new hires before their first day on the job.

The parallels between Finnegan's (2010) guidelines for supervisors and the concept of building relational trust are noteworthy. Employees, who feel supported, appreciated, cared for, and valued, are likely to choose to stay with an organization. Their basic needs for safety, belonging, and esteem are met in such an environment. Finnegan’s (2010) principles of employee retention, and employees’ need for esteem, in particular, are evident in Johnson and Birkeland's (2003) study of new teachers' career decisions. Their study and others’ (Alliance for Excellent Education, 2008; McKinney et al., 2007) have shown that teacher effectiveness is a

strong predictor of teacher retention. Teachers who feel they are successful in teaching their students and promoting their students' achievement are more likely to remain in a position than are those who are struggling with low student achievement.

Two of Finnegan's (2010) descriptions of supervisory skills that promote employee retention speak strongly to employees' need for esteem. The ideas that, "We do great things here," (p.107) and "I feel great when I leave work because I know I've done something good," (p. 108) align with studies of teacher attrition that point to efficacy as the fundamental reason that many teachers decide to stay or leave a position. For example, the Alliance for Excellent Education (2008) has stated that the key reason teachers remain in positions is their success in improving their students' performance. Similarly, as has already been mentioned, Johnson and Birkeland's (2003) study of 50 Massachusetts public school teachers revealed the pivotal role of a teacher's success in the classroom. In addition, their study demonstrated that teachers viewed their school site as having conditions that either supported and fostered their success or thwarted it. Teachers looked to school administrators, colleagues, and other school site factors to help ensure their success as teachers (Johnson & Birkeland, 2003).

The importance of teacher efficacy discussed here might also explain the findings of other studies of teacher turnover. Specifically, research has shown that effective teachers tend to remain at a particular school, while teachers who are less effective tend to leave their positions (Alliance for Excellent Education, 2008; Goldhaber, Gross, & Player, 2011). These results emphasize the importance of helping new teachers learn the skills they need to be successful in the complex role of classroom teacher.

Few teacher retention researchers have drawn connections between employee retention in the private sector and public school teacher retention. Ingersoll and Smith (2003) have noted that private enterprise views employee retention more seriously than does public education. They attribute this difference to the costs of attrition, especially in work environments that depend upon effective interactions among employees. In such environments, high turnover rates can affect program continuity, employee commitment, and cohesion (Ingersoll & Smith, 2003). If one applies this perspective to teacher attrition, the negative implications of high teacher turnover are compelling. The harmful consequences of teacher attrition are likely to include school climate problems and reduced student achievement (Ingersoll & Smith, 2003).

The premise of *Rethinking Retention in Good Times and Bad* (Finnegan 2010) is that employee retention efforts are generally inadequate and require research-based input to become effective. Finnegan (2010) recommends a new retention model that places accountability for employee retention on workplace supervisors. It examines what the employer uniquely offers employees, and it is founded on positive, trusting relationships with supervisors. In addition, the proposed retention model is guided by commitment and action from top executives. Finnegan's (2010) tone of urgency regarding employee retention efforts is also evident in Mary Lou Santovec's (2010) comments, "Employee turnover has two causes: poor hiring and poor treatment. Poor hiring is unfortunate; poor treatment is inexcusable" (p. 20).

Implicit in the sense of urgency expressed by these authors, is the conviction that improved retention of effective employees has the potential to produce significant gains for the organization, industry, or service. It is this promise of revealing the under-recognized potential of employees that guides the present study of teacher retention.

Applications

The purpose of this literature review has been to identify salient factors affecting teacher retention in urban settings. The literature on this topic is diverse. Some studies have focused specifically on urban settings (Andrews & Donaldson, 2009; Donaldson, 2009; Donaldson & Johnson, 2011; Jorissen, 2003; Keller, 2007; Kirchhoff & Lawrenz, 2011; Ng & Peter, 2010; Shernoff et al., 2011; Taylor & Frankenberg, 2009), while others have addressed a variety of settings: urban, suburban, and rural (Certo & Fox, 2002). Some studies have focused on particular factors, such as mentor programs (Brown, 2003; Ingersoll & Smith, 2004), while others have reviewed a variety of factors (Certo & Fox, 2002; Ingersoll, 2001; Ingersoll & Smith, 2004). Although some studies have focused on specific subjects such as math and science (Baker & Keller, 2010; Kirchhoff & Lawrenz, 2011; LaTurner, 2002; Ng & Peter, 2010), others have examined a variety of subjects (Certo & Fox, 2002). The approach to research, quantitative and qualitative as well as mixed methods, has also varied among studies. The diversity of topics and methods illustrates not only the complexity of the topic, but also the significance of it for education in our country.

From a practical perspective, the intention of this review has been to identify factors that schools and school districts can influence to improve their retention of qualified teachers. The literature strongly supports the importance of pre-service teacher education as a factor affecting teacher retention. In particular, studies have illustrated the correlation between the quality of urban-focused teacher education programs and increased teacher retention or, at least, an improved probability of teacher retention (Jorissen, 2003; Kirchhoff & Lawrenz, 2011; Taylor & Frankenberg, 2009). In general, however, schools and districts are not able to effect change in teacher education programs.

From this literature review, therefore, three categories of factors emerge as key areas for interventions that will enhance teacher retention in urban schools. The first of these, induction programs, including mentor programs, offer schools the opportunity to support their new educators in a meaningful way. The second category, professional community, can inform efforts to strengthen induction programs. Educators have reported that professional relationships, together with the support and the exchange of ideas they provide, affect their decision to remain in a particular school. Thus, it would seem that a quality induction program, and a robust professional culture, would be mutually reinforcing in the retention of educators in urban settings.

School leadership, the third category of retention factors, stands out as a decisive factor in teacher retention. Since school leadership affects many characteristics of a school's culture, it is understandable that it would have such a profound effect on teacher retention. Effective leadership for teacher retention, however, requires school leaders to be aware of their influence and adjust their focus of leadership accordingly. In its publication, *District Standards and Indicators*, the Massachusetts Department of Elementary and Secondary Education (DESE) (2011) addresses the role of educational leaders in fostering the growth of teachers. The MA DESE advises, "The district places a high priority on retaining and maximizing the impact of effective professional staff by providing new roles and opportunities for growth and a career ladder" (Massachusetts Department of Elementary and Secondary Education (DESE), 2011, p. 3). The Massachusetts standard addressing professional development further develops the concept of promoting teachers as leaders, "The district supports teacher leadership and growth by creating opportunities for exemplary teachers to have responsibility for instructional leadership and mentoring" (p.3). As school leaders foster a collaborative culture, sharing leadership and

decision-making with their teachers, the enhanced professional climate is likely to become self-reinforcing. Improved student achievement would be an expected result.

Recent literature offers approaches to strengthening and enhancing school leadership. The suggestions they propose hold promise for improving teacher retention rates. For example, in *The Strategic School*, Miles and Frank (2008) identify three primary resources that high-performing schools manage and develop. They are the schools' people, time, and money. Miles and Frank offer recommendations for continuously improving teacher quality:

A. Hiring and organizing staff to fit school needs in terms of expertise, philosophy, and schedule
B. Integrating significant resources for well-designed professional development that provides expert support to implement the school's core instructional design
C. Designing teacher work schedules to include blocks of collaborative planning time effectively used to improve classroom practice
D. Enacting systems that promote individual teacher growth through induction, leadership opportunities, professional development planning, evaluation, and compensation (Miles & Frank, 2008, p.24)

Recommendations B, C, and D (Miles & Frank, 2008), in particular, address teacher retention factors that have been highlighted in this review.

Steven Kimball (2011) proposes a new role for principals, one that extends beyond the concept of instructional leader, which has been prevalent for several years. His vision aligns well with the leadership initiatives and approaches described by Miles and Frank (2008). Kimball (2011) describes the role of principals as "strategic talent managers" (p.13). In this new

paradigm, principals plan strategically for the recruitment of new staff and for the support and development of teachers toward the attainment of the school's vision. Principals foster the collaboration of teachers and provide opportunities for teacher leadership. Furthermore, they clearly communicate school goals and help describe measurable student goals to teachers for their use in instruction and reflection on student achievement. Additionally, when monitoring teachers' progress toward school goals, principals provide specific and timely feedback based on classroom visits.

A recent study that compares the perceptions of teachers and principals regarding professional support has confirmed the importance of principals' feedback to novice teachers (Andrews et al., 2012). New teachers have described their need for constructive feedback on their classroom performance. However, the feedback they seek is independent of the school's formal evaluation protocol. In addition to establishing an open and respectful relationship with teachers, school leaders can review and discuss lesson plans, provide instructional feedback based on classroom visits, and help novice teachers set reasonable goals for themselves (Carver, 2003). Ongoing, constructive feedback by school leaders would address some of the significant concerns that dissatisfied new teachers have cited. Simultaneously, while helping to reduce attrition, such an approach would strengthen teachers' skill sets.

The actions of a principal in the role of "strategic talent manager" (Kimball, 2011, p.13) would also address many of the concerns new teachers describe regarding school leadership. For instance, this type of leadership conveys respect for teachers, emphasizes the value placed upon their expertise, and provides them with opportunities for professional collaboration. By adopting these strategies for investing in teacher quality (Miles & Frank, 2008), school leaders may enhance their school's retention of quality teachers.

Because there are so many demands on the time and energy of urban principals, the importance of their efforts to improve teacher retention could easily be underestimated. However, as school leaders witness the professional culture and student achievement benefits that may result from their efforts to hire and retain high quality educators, it is likely that this leadership role will become a priority.

Science Teacher Retention

Mathematics and science are among the fields particularly prone to staffing shortages (Ingersoll & May, 2012; Klentschy & Molina-De La Torre, 2003). In fact, several authors in this review have investigated the issues associated with teacher retention in mathematics and science (Baker & Keller, 2010; Clotfelter et al., 2008; Ingersoll, 2011; LaTurner, 2002; Ng & Peter, 2010). For the present study, science is the discipline of primary interest. However, both science and mathematics are often examined together due to their inherent connections. Characteristics that contribute to the severity of staffing problems in these subject areas include high poverty, high minority composition, and urbanicity. Such schools show some of the highest mathematics and science teacher attrition rates (Ingersoll & May, 2012).

Data obtained from the National Center for Education Statistics' Teacher Follow-up Surveys from the late 1980s to 2005 revealed that the yearly teacher turnover rose by 10% for science teachers, and by 34% from mathematics teachers (Ingersoll & May, 2012). Interestingly, turnover rates from mathematics and science teachers during this period were not consistently different from the turnover rates observed in other disciplines, such as social studies (Ingersoll & May, 2012). Close analysis of the data from these years reveals differences in teacher attrition, relative to school demographics. In particular, mathematics and science teachers' (as well as

others') turnover correlated with school factors such as poverty minority population and urbanicity (Ingersoll & May, 2012). This analysis of Teacher Follow-up Survey data also showed that mathematics and science teachers were not more likely than teachers of other subjects, to leave education positions for non-education jobs (Ingersoll & May, 2012).

This study (Ingersoll & May, 2012) documented a sizable annual movement of mathematics and science teachers from urban to suburban schools. The analysis confirmed that urban schools with high poverty and high minority student populations are affected inordinately by teacher turnover. Moreover, the observed asymmetry of mathematics and science teacher turnover was also apparent among teachers of other subjects (Ingersoll & May, 2012).

Ingersoll and May (2012) examined 2004 – 2005 Schools and Staffing Survey (SASS), data to discern the primary reasons teachers leave their positions. Of particular interest was the significant percentage of science teachers (approximately 62%) who reported that job dissatisfaction or their desire to obtain a better position was a major reason they left the teaching job. This finding is in contrast to approximately 46% of non-science and non-mathematics teachers and 48.4% of mathematics teachers. The 2004 – 2005 data revealed that science teacher turnover was, however, slightly less than that of other teachers. Other factors that were examined for their effects on teacher turnover included maximum salary, student discipline problems, administrative support, availability of supplies and materials, and teacher input for school decision-making, teachers' classroom autonomy, and professional development. The review of these factors revealed that, for science teachers in the 2004 – 2005 school year, the strongest predictors of turnover were the district's maximum salary, the level of student discipline problems, and content-focused professional development (Ingersoll & May, 2012). Furthermore, schools' organizational characteristics were noted to have a cumulative impact on

teacher retention (Ingersoll & May, 2012). Retention was higher, the more positive the organizational characteristics a school possessed. The authors concluded:

> These findings provide support for a theoretical perspective that school organization, management, and leadership matter. Schools exhibiting more characteristics associated with effective organization, and more of the indicators associated with professionalized workplaces, had significantly better retention of math and science teachers. (Ingersoll & May, 2012, p. 23)

The observed correlation between teacher turnover and school demographics is of particular relevance to the present study. Ingersoll and May (2012) observed that poor organizational conditions occur disproportionately in high poverty urban schools. Therefore, the observed higher attrition in rates in the schools derived from their poor organizational characteristics, rather than from the demographic characteristics of their students (Ingersoll & May, 2012). The authors acknowledge that, while improved organizational conditions in poor urban schools would likely improve teacher retention, the process of attaining these improved conditions is likely to be a challenging one, and research is needed to identify the best ways to foster these changes.

While Ingersoll and May's (2012) study used a quantitative approach to analyze data provided by the national Schools and Staffing Survey and its Teacher Follow-up Survey, others have used qualitative approaches to study science teachers' retention, career paths, and instructional practices (Harcombe, 2005; Moscovici, 2009; Rinke, 2011). These studies illustrate some subtleties in the field of science teacher turnover that are not immediately evident in the work of Ingersoll and May (2012).

Moscovici (2009) has identified one such retention factor for science teachers in urban schools. The importance of a cohesive vision for science education was discovered through a study of six years of data derived from secondary science interns who were taking methods classes in a Southern California urban university. The data for this study were collected from more than 233 participants who were credential candidates; data sources included participants' reflections regarding topics addressed in methods courses, supervisors' field notes from classroom visits, participants' reactions and feedback addressing in-service programs, as well as interviews. In summarizing, Moscovici (2009) notes,"… interns seem to prefer schools, school districts, and credential programs that share power sources with the stakeholders involved and build a cohesive vision regarding science education, a vision that is also supported by state policies" (p. 101). Accordingly, Moscovici (2009) recommends that efforts to improve science education in urban settings need to adopt a systems approach that incorporates comprehensive and unified solutions rather than isolated interventions.

Other research has documented science teachers' need for support in the implementation of effective science instruction in urban settings (Harcombe, 2005). In Houston, Texas, secondary science teachers who participated in the Model Science Lab, a professional development program in existence for over 14 years, showed a 96% retention rate for science teaching and a 74% retention rate for 15 or more years in Houston's city schools. The Model Science Lab program is a collaborative effort between the Houston Independent School District and Rice University's Center for Education. The program is founded on a constructivist approach to professional development; it includes a full year of focused attention on constructivist teaching of science in urban schools. Participating teachers relocate to a Houston school that is part of the Model Science Lab program for one year. During this year of residency, teachers

attend classes in pedagogy and content, observe classes taught by expert science teachers, attend conferences, teach a reduced load (one science class), and actively reflect on their own teaching. In addition to the noteworthy impact this program has had on urban science teacher retention, results have confirmed student benefits as well. Model Science Lab program graduates have noted increased engagement of their students following their training (Harcombe, 2005). Furthermore, when Model Science Lab program teachers return to their own schools following their residency, their students' standardized test performance shows improvement, and these improvements have been shown to persist over time (Harcombe, 2005).

The complexity of science teacher retention is illustrated by studies that examine the views or mindset of teachers. For example, Carol Rinke (2011) has shed light on the role of teachers' personal experiences and perspectives in science teacher retention. Through a two-year longitudinal study, she examined urban science teachers' thinking about their careers. Using a case study methodology, her study revealed that teachers' lived experiences and initial perspectives about teaching, affected their views on their careers. Although some case study teachers held a perspective of full integration into the profession, others remained at a less committed level of participation. The observed continuum of teachers' perspectives ranged from those teachers who wanted to integrate fully into their school communities, by participating in school initiatives and developing relationships with colleagues and students, to those teachers who wanted to be much less engaged in their positions. These teachers, referred to as *participants*, did not become deeply committed to their positions. They avoided involvement in school initiatives and preferred to work independently rather than collaboratively with colleagues. Rinke (2011) asserts that teachers' perspectives act as filters for both their contextual and individual experiences, and these perspectives therefore affect decisions about their career

moves. Rinke (2011) observes, "This study suggests that factors related to retention continually intersect with the biographies and perspectives of individual teachers to shape their career trajectories" (pp. 655 – 656). This finding suggests the importance of considering teachers' backgrounds when designing efforts to support them in urban settings.

Teacher retention in the fields of mathematics and science often involves educators who are pursuing this profession as a second career (Hart Research Associates, 2010). In other words, they may have worked in a different profession for several years, and subsequently decided to become teachers. The question arises as to the factors that may contribute to the retention of these second-career educators. Because they have had experiences in another profession, the factors that affect the retention of second-career educators may be different from those that influence the retention of individuals for whom teaching is their first career. Our schools need quality mathematics and science educators to develop students who are mathematically and scientifically prepared for future study and for careers in these fields. Therefore, the retention of second-career educators warrants further discussion.

Second-career Educators

Second-career educators offer a viable approach to filling teaching positions with qualified professionals (Resta, Huling, & Rainwater, 2001). These teachers describe both altruistic and personal benefits derived from their career change (Chambers, 2002). The question arises, however, as to whether retention factors for career-changers are different from those that affect first-career teachers. This might be the case if there are some inherent differences in first and second-career teachers' values, mindset, and skills. In fact, studies of second-career educators have revealed that career-changers see themselves as being different from first-career teachers in several important ways (Chambers, 2002). For example, second-career teachers feel

that they bring valuable prior professional skills and experience to their teaching as well as a desire to help students recognize real world applications of what they are learning in school (Chambers, 2002). These teachers also perceive themselves as being open to new pedagogical methods, including applied learning approaches (Chambers, 2002).

Career changers also bring different perspectives and face unique challenges when becoming classroom educators (Etherington, 2011; Resta et al., 2001). For instance, they may bring an assertive and determined approach to their new career as well as an expectation for problem solving and collaboration among school leaders and teachers (Resta et al., 2001). Following his study of 17 second-career educators in the primary grades, Etherington (2011) concluded that career-changers' perceptions about teaching, their perspectives, and their worldviews need to be considered for their successful transition into teaching. Etherington (2011) recommends that career changers' perspectives and expectations guide the processes used for developing orientation and induction, including mentoring, programs.

Others have also highlighted the need for induction and professional development offerings tailored to address the characteristics of career-changers. Sawchuk (2008) has emphasized that a one-size-fits-all style of induction and in-service training is likely to be ineffective for second-career teachers who bring a variety of experiences and skills to their new positions.

Similarly, some have recommended that the pre-service training of prospective second-career educators be modified in light of career-changers' unique characteristics and needs (Resta et al, 2001; Sawchuk, 2008). Resta and colleagues (2001) described quality teacher-preparation programs for second-career educators in this way:

Strong midcareer preparation programs are characterized by

- Strong content preparation aligned with state and national standards.
- Rigorous curriculum in human growth and development, principles of teaching and learning, classroom management, instructional strategies, curriculum development and integration, assessment of student learning, technology applications, and content pedagogy.
- Substantial amounts of structured fieldwork and intensive clinical experiences
- Support from peers and mentors throughout the induction period. (pp 62 -63)

The importance of targeted support for new career-changers has been echoed in a 2010 report sponsored by the Woodrow Wilson National Fellowship Foundation (Hart Research Associates, 2010). While describing characteristics of career-changer teachers in general, this study also reported on specific characteristics of math and science teachers. It revealed that math and science teachers are more likely to have worked for 10 or more years in their prior career than are their non-math and non-science counterparts. Furthermore, this study reported that math and science career-changers are less likely than other career-changers to have completed a traditional university-based preparation program before starting their teaching career (Hart Research Associates, 2010). The lack of traditional teacher training may produce a greater need for quality induction programs, including mentor programs, and in-service training for second-career science and math educators.

Adult learning theory. Planning for effective pre-service, induction, and ongoing professional development experiences for teachers requires an understanding of adult learning. Adult learning theory emphasizes that the particular needs of adult learners are critical

determinants of the effectiveness of learning experiences (Mezirow, 2012; Mundry, 2003; Tennant & Pogson, 1995). Susan Mundry (2003) has described six assumptions that are foundational to adult learning:

- Adults need to know why they need to learn something before they learn it.
- Adults have a concept of themselves as responsible for their own decisions and will resist situations in which others impose their will.
- Adults have rich, diverse experiences.
- Readiness to learn affects adult learning.
- Adults' orientation to learning is life-centered or problem-centered.
- Adults are motivated to learn by internal pressures (Mundry, 2003, p. 124 – 126)

The third assumption, that adults have rich and diverse experiences, may have greater implications for second-career educators who have had a number of years of experience in a previous career than for first-career teachers.

Career-changers bring their prior knowledge, expertise, and experiences to their new teaching career. In fact, at least some of these teachers have expressed their intention to apply their previously acquired skills and knowledge to their classroom teaching (Etherington, 2011). The effects of life experiences on the process of adult learning will be revisited following a discussion of the development of adult intelligence.

Mundry (2003) explains that adult learners require instruction that connects new learning with their experiences. Absent these connections, the adult learner may reject or block the new learning. From the perspective of teacher retention, such a negative reaction to new learning

could contribute to reduced teacher efficacy and, as has already been discussed, increased attrition (Johnson & Birkeland, 2003).

The role of experience in intellectual development has become widely recognized in the contemporary theory of adult intelligence (Tennant & Pogson, 1995). Traditional written IQ assessments are no longer seen as adequate measures of intelligence. Rather, life experiences are broadly recognized as significant contributors to adult intellectual development (Tennant & Pogson, 1995), and practical intelligence has gained greater acceptance as an integral part of adult intelligence. Accordingly, developers of adult educational experiences must consider the practical component of adult intelligence when designing learning programs. With respect to the present discussion of career changers' transition into teaching, it follows that an understanding of the complexities of adult intelligence should inform the design of learning opportunities, such as induction programs, for first-career and second-career educators. In particular, it is likely that the extensive professional experiences of second-career teachers affect their adjustment to a new career in teaching in ways that are different from that of the first-career educator.

Tennant and Pogson (1995) have described the importance of using this deeper understanding of adult intelligence in the development of effective adult learning programs:

> It is our argument that adult intelligence and cognitive development can be re-conceptualized as comprising both practical intelligence and expertise. Such a re-conceptualization should not be understood as excluding IQ, or indeed any number of other cognitive constructs. Rather, we believe that adulthood can be reframed from this perspective in such a way as to shed light on adult development and adult learning. (Tennant & Pogson, 1995, p. 37).

Considering the critical influence of experience on adult intelligence, adult learning theory must be applied to the design of professional development for teachers if these programs are to be effective. Jack Mezirow (2012) has described the process of transformative learning among adults:

> Transformative learning refers to the process by which we transform our taken-for-granted frames of reference (meaning perspectives, habits of mind, mind-sets) to make them more inclusive, discriminating, open, emotionally capable of change, and reflective, so that they may generate beliefs and opinions that will prove more true or justified to guide action. Transformative learning involves participation in constructive discourse to use the experience of others to assess reasons justifying these assumptions, and making an action decision based on the resulting insight. (Mezirow, 2012, p. 76)

Mezirow (2012) defines frames of reference as "– the structure of assumptions and expectations through which we filter sense impressions" (p. 82). He refers to frames of reference as *meaning perspectives* that result from our interpretations of experiences. Our frames of reference, in turn, influence our perceptions, feelings, and our cognition. In other words, they provide the context for making meaning of our experiences (Mezirow, 2012). Cumulative life experiences, including our cultural paradigms, contribute to the development of our frame of reference. In turn, one's frame of reference, which includes point of view and habits of mind, influences learning. This is the case because the frame of reference serves as a lens through which one evaluates new knowledge and experiences. Depending on the nature of new information or an experience, our frame of reference may inhibit learning. Learning is impeded, for instance, whenever we perceive a new experience as being contradictory to our established knowledge (Mundry, 2003).

Mezirow's (2012) explanation of transformative learning effectively highlights some potential differences between first-career and second-career educators. Because career-changers may have had many years of experience in a non-teaching career, they are likely to bring different frames of reference to their teaching than do first-career teachers who have entered teaching positions immediately following their post-secondary education.

An example of differing frames of reference can be found in Etherington's 2011 study of pre-service primary school teachers. In this Canadian study of career-changers, Etherington (2011) analyzed the worldviews of seventeen mature, pre-service teachers. For this research, worldview was described as the way an individual interprets the world and applies this interpretation to his or her life. Interviews of the pre-service career-changers, who ranged in age from 31 to 53, revealed three categories of worldviews: *traditionalists*, *moderns*, and *achievers* (Etherington, 2011, p. 37). Most of the career-changers in this study demonstrated the *traditionalist* worldview. The teachers in this group shared a belief in working collectively for the common good. They made connections between parenting and teaching, and expected to establish a community of learners in their classrooms. The *traditionalists* displayed a commitment to teaching and envisioned themselves working beyond the school day. Furthermore, their comments revealed a greater focus and value on building students' self-esteem than on promoting their academic achievement (Etherington, 2011).

Etherington (2011) observed the *modern* worldview in two of the teachers in this study. These individuals did not view teaching as a vocation or calling. On the contrary, their reasons for choosing the teaching profession were grounded in practicality: developing leadership skills, acquiring social status, and procuring steady employment. They viewed a teaching career as dependable employment that they hoped would lead them to independence.

Etherington (2011) categorized the third group of career-changers as the *achievers*. Each of these three individuals came from a previous career in business. This group expressed the desire and intention to apply the knowledge and skills they had acquired in the business field to their classroom instruction. They were focused on using high quality presentations and goal-setting to promote their students' achievement.

Within the group of seventeen career-changers that Etherington (2011) studied, the diversity in frames of reference is striking. Assuming these results can be applied to the broader population of career-changers in schools, the implications for transformative learning in schools are profound. Etherington (2011) has remarked that the views of some second-career educators can be in conflict with practices common to primary school instruction. For instance, the worldview of *achievers* in his study included a negative response toward revision and routines in teaching. Etherington (2011) observed that both revision and routines are characteristic of Canadian public school teaching in the primary grades. He concludes, "…it is important to be conscious of and responsive to the particular worldviews on which second-career teachers ground their pedagogical perceptions and intentions" (Etherington, 2011, p.48). The most effective adult learning programs, including induction and mentoring programs, might be expected to be those that account for the experience-influenced worldviews of second-career educators.

Reflective discourse is another key aspect of transformative learning emphasized by Mezirow (2012, p.78). *Reflective discourse* requires the learner to evaluate prior assumptions. It also requires individuals to exchange ideas, and it benefits from the sharing of insights derived from different personal experiences. Mezirow (2012) contrasts the collaboration associated with discourse with the more common cultural norm of competition. Such competition is pervasive

and widely accepted in many aspects of our lives, including political discourse. *Reflective discourse* can be a part of many professional development initiatives in education. Induction programs, mentor programs, and professional learning communities offer venues for *reflective discourse* to support the successful transition of both first-career and second-career teachers.

Susan Mundry (2003) has applied the principles of transformative learning to the experiences of adult learners who are science teachers. Mundry (2003) explains that new science teachers, confronted with dissonance between new teaching experiences and their frames of reference, need opportunities for critical reflection about their conflicting beliefs. In addition, she asserts that teachers need to engage in a discussion about this experience with a coach or mentor (Mundry, 2003). Furthermore, for this conflict to be resolved in a way that ultimately leads to a change in the learners' frame of reference, Mundry (2003) emphasizes that the critical reflection must be sustained over time. Mundry (2003) applies the principles of transformative learning to the particular example of new educators embracing an inquiry approach to science teaching rather than the traditional instruction they may have received as students themselves. Mundry (2003) cautions that effective change requires that the reflective process be supported by opportunities for the teacher to apply the new learning in the context of his or her own classroom teaching. Thus, in the example of inquiry-based science instruction, the teacher would implement the inquiry approach with his or her own students, rather than merely observe examples of the practice in a professional development experience. Mundry (2003) asserts that the transformative learning process also requires the teacher-learner to use the changed frame of reference to develop new teaching practices that align with the new way of thinking. A mentor's ongoing support is essential throughout this process as well (Mundry, 2003).

When considering the extensive and varied experiences that new teachers encounter as they transition into the profession, the need for a cyclic approach to transformative learning becomes clear. Adult learners will continue to encounter new experiences over time. Those experiences that challenge their frame of reference will call for sustained critical reflection, discourse, opportunities for application, and ongoing support if they are to lead to transformative learning (Mundry, 2003). Thus, transformative learning requires a commitment of time, personnel, and resources on the part of schools and school districts. Naturally, such a commitment to transformative learning is likely to require significant expenditures. Nevertheless, the potential benefits of such commitment are noteworthy. For example, as has been previously described, a comparison of two Florida school districts' costs to replace new personnel revealed a correlation between teacher replacement costs and teacher attrition (Shockley et al., 2006). The school district with the higher teacher replacement costs had the lower attrition rate. The study's authors noted that this district had invested in a new, comprehensive induction program for their new teachers. Investment in this program resulted in lower attrition. Thus, in the end, the district's overall costs were reduced because of the improved teacher retention the induction program generated (Shockely et al., 2006).

This discussion of the role of experience in intelligence development and its involvement in transformative learning highlights some special characteristics of career-changers. Susan Mundry's (2003) list of six foundational assumptions of adult learning identifies the importance of adults' "rich, diverse experiences" (p. 124 – 126). This assumption applies to second-career educators on two levels: the personal demands associated with one's stage in life and the expertise acquired through one's personal life and career experiences. First, career-changers are likely to be somewhat older than most first-career teachers are. This age difference contributes to

differences in life-course stages, such as starting a family or having young children. Such life experiences, due to demands on one's time for family commitments, can produce specific personal demands and, therefore, affect professional choices. The issues related to one's stage of life, and its associated challenges, are generally beyond the ability of schools to address. However, schools are in a position to effect change with respect to the second level of relevance for career-changers, life and professional experiences. Because second-career teachers are likely to be older than their first-career counterparts are, they may bring with them expertise derived from an array of different life experiences. Tennant and Pogson (1995) explain, "… general life experiences not only shape the perspectives or frames of reference one brings to the work environment, they can have an impact on specific aspects of practice (for example, pediatricians or child care workers experiencing parenthood, or marriage counselors marrying or divorcing)" (p. 64). Furthermore, as has already been described, the professional experiences that second-career educators have had in their previous career, help to build the practical knowledge and skills, or expertise, that contribute to their adult intelligence (Tennant & Pogson,1995). Schools can address these characteristics of career-changers through their leadership practices, induction programs, mentor programs and professional development initiatives.

Turnover of second-career educators. In the report, *Career Changers in the Classroom: A National Portrait* (Hart Research Associates, 2010), the Woodrow Wilson National Foundation presents the results of interviews of 504 educators from across the nation who had worked at least 3 previous years in a field other than teaching. A majority of this diverse population of teachers (52%) expressed happiness in their decision to enter teaching and indicated that they planned to continue teaching for 10 or more additional years (Hart Research Associates, 2010). The participants reflected diversity across many factors, including their

current age (25 years – over 50 years) and the number of years in their first career (3 years to more than 10 years). They also varied with respect to the number of years they had been teaching (<3 years to 20 years) and the grade level at which they were teaching (pre-K to senior high school).

The happiness and commitment to teaching expressed by the diverse population of second-career educators in the Woodrow Wilson National Foundation (Hart Research Associates, 2010) survey might initially lead one to conclude that teacher attrition is not a concern among career-changer educators. Yet not all studies have reported the same level of second-career teacher satisfaction. Contextual factors may account for differences in career-changers' perceptions of their new career experiences. For example, in a 2003 study of midcareer entrants to teaching, Johnson and Birkeland (2003) reported that career-changers were three times more likely to move from one school to another than were first-career teachers. The authors describe the career-changers in their study as being less tolerant of schools that did not support good teaching. Johnson and Birkeland (2003) suggest that second-career teachers, having already executed a career change that may have resulted in a salary reduction, would also be inclined to switch schools in order to find a work environment in which they would succeed. Their study of midcareer entrants also revealed that those who had completed an alternative certification program had higher attrition rates that those who had completed a traditional program. It is important to note that the authors caution against generalizations based on their findings since other factors, such as poor matches of new teachers and their schools, may have contributed to the observed attrition. Nevertheless, the findings of Johnson and Birkeland (2003) highlight the need for further study of career changers in specific contexts.

The unique characteristics of second-career educators, especially those who enter teaching after 10 or more years in a previous field, pose challenges for their successful integration in a school's culture. One of the factors influencing teacher retention generally in urban settings is the nature of the school's leadership (Certo & Fox, 2002; Donaldson, 2009; Donaldson & Johnson, 2011; Ingersoll, 2001; Ladd, 2011). Interestingly, mature second-career educators present a different outlook on teaching that school administrators may need to understand if they are to promote the retention of career-changers. Resta et al. (2001) explain that although midcareer changers have considerable experience with bureaucratic entities, these individuals have little tolerance for what they perceive to be bureaucratic expectations (policies and paperwork) that interfere with their ability to attend to the needs of their students. Resta et al. (2001) caution that school leaders need to be cognizant of the ways second-career educators differ from their first-career colleagues. For example, midcareer changers may be more assertive, vocal, and resolute than first-career teachers. Second-career experienced professionals also may expect a school climate that includes collegial and administrative support (Resta et al., 2001).

The effect of school leadership on teacher retention in urban settings has been well documented (Certo & Fox, 2002; Donaldson & Johnson, 2011; Ingersoll, 2001; Ladd, 2011). Second-career educators who have spent several years in their first career bring strength, commitment, and little tolerance for bureaucratic interference to their teaching assignments (Resta et al., 2001). Therefore, school leaders may need to adjust the way in which they interact with midcareer teachers for their successful transition into teaching.

Summary

This review of the literature on the attrition characteristics and retention factors affecting teachers in America's public schools has demonstrated both the complexity and the evolution of our understanding of these issues. Teacher attrition patterns have been examined and attrition theory (Grissmer & Kirby, 1987) has been summarized. The specialized case of teacher retention in urban settings, especially in specialized fields like math and science, highlights the need for additional research. This review has summarized studies of factors affecting teacher retention, with the purpose of revealing the most critical factors that schools can influence to improve the retention of quality teachers. The literature has shown that teachers' perceived effectiveness in their positions, as measured by student achievement, is a strong predictor of their decision to remain in a particular position. Simultaneously, the literature has revealed that teachers' cite school working conditions, including school leadership and collegial support, as significant determinants of their effectiveness. Thus, this review raises the question of whether improved school conditions, especially in the areas of school leadership and professional culture, can enhance teacher effectiveness, thereby improving teacher retention. Furthermore, the question arises as to the particular characteristics of school leadership, mentor programs, and other forms of collegial support that teachers perceive as contributing to their retention. The present study focuses on the retention of first-career and second-career science teachers in urban high schools. This literature review has documented the challenges of science teacher retention and the increasing number of second-career educators in public schools. The present study addresses the factors that science teachers perceive as influencing their retention or attrition decisions. It examines samples of first-career educators and second-career educators in order to identify potential differences in the perceptions of these two groups. The magnitude of teacher attrition

effects in high-need schools illustrates the urgency of research that will improve the ability of urban schools to retain their quality science teachers.

CHAPTER THREE: DESIGN OF THE STUDY

This chapter presents the procedural framework for this study. It begins with a brief restatement of the study's purpose, its contextual framework, and the research questions that guide the study. By way of bracketing biases, the researcher's relevant background is described. The design of the study is presented with a description of the study population, participant recruitment methods, and instruments used for the quantitative and qualitative components of the study. The chapter continues with an explanation of the plan for data analysis, which is followed by a discussion of measures of validity and reliability, including a description of a pilot study. Following an explanation of the study's limitations, a brief summary of the research methodology is provided.

Purpose and Context

This study seeks to examine factors that affect science teachers' retention and attrition in secondary schools serving communities of high need in New England. For more than 25 years, concerns about the rate of teacher turnover in schools have prompted empirical research. Teacher turnover varies with academic discipline and school demographics. Science is among the subject areas marked by significant teacher attrition, and urban schools, in particular, face serious teacher turnover levels. Therefore, the primary objective of this study is to identify and examine science teacher retention and attrition factors with the goal of informing leadership practices to support the development and retention of quality science teachers in urban high schools.

Schools' efforts to recruit science teachers have included reaching out to career-changers. With alternative licensure programs designed to assist their transition, professionals from a variety of careers, including business, health care, pharmaceuticals, and engineering, have been

entering the teaching professional for many years. This study also seeks to compare and contrast the retention and attrition factors of first-career and second-career science teachers. The goal of this analysis is to discern differences between these two populations of science teachers that may be informative for the design of induction/mentoring programs and for the development of professional communities in schools.

Lastly, the study seeks to identify and examine leadership practices in light of the science teacher retention and attrition factors revealed by this research. School leaders may be able to use the information from this study to enhance the assimilation, professional development, effectiveness, and retention of novice science teachers in their schools.

Methodology

To investigate factors affecting the retention of high school science teachers in urban settings, this descriptive study used a sequential mixed methods approach, in which qualitative data acquisition followed quantitative data (Denscombe, 2010). Mixed methods research "… combines alternative approaches within a single research project" (Denscombe, 2010, p. 137). This dissertation study employs a basic mixed methods approach by incorporating both quantitative and qualitative research methods (Denscombe, 2010). An online survey (Appendix A) developed by the researcher using items that were grounded in the teacher retention literature provided quantitative data. Urban area science teachers in New England high schools were recruited by e-mail to participate in a survey designed to elicit their perceptions of factors that affect their employment decisions. Those who completed the survey could also volunteer for a follow-up interview, which provided the study's qualitative data.

Denscombe (2010) explains that in mixed methods research, "… the research needs to have a clear and explicit rationale for using the contrasting methods" (p. 147). In this study, the

quantitative data formed a baseline understanding of teachers' perceptions of school conditions that affect their retention. These factors were derived from a large number of respondents, and quantitative analysis allowed for the investigation of differences between the perceptions of first-career and second-career teachers. Interviews were semi-structured (Denscombe, 2010), consisting of four main open-ended questions addressing teachers' reasons for choosing a teaching career, their perceptions about teaching in an urban setting, their perceptions about conditions that affect their commitment to a teaching position, and their thoughts about conditions school leaders could create to foster science teacher retention (Appendix B). The interviews of a subset of survey participations enabled the researcher to assess the validity of survey findings as well as enrich understandings of science teachers' perceptions of retention and attrition factors. The qualitative analysis fostered the identification of themes among the many retention factors that could guide school leaders in their work with new science teachers.

Research Questions

The following research questions guide the research methodology, data collection, and analysis:

1. What are the conditions necessary to retain new science teachers in urban area high schools?
2. What are the similarities and differences in retention-promoting factors and attrition factors between first-career and second-career science teachers?
3. How do urban school leaders create the necessary conditions to foster retention of quality science teachers?

Researcher's Role

The researcher designed the quantitative and qualitative research tools for this study. Their development was informed by literature in the fields of teacher retention and employee

retention, generally. The researcher recruited participants, collected, analyzed and interpreted the quantitative and qualitative data, and synthesized conclusions in accordance with established research practices (Creswell, 2007; Denscombe, 2010; Glesne, 1999; Maxwell, 2005; Salkind, 2011).

It is customary for researchers to bracket their views prior to embarking on analysis of qualitative research (Creswell, 2007). Such is the case, for example, in Creswell's (2007) discussion of phenomenological research. He states, "…I see researchers who embrace this idea when they begin a project by describing their own experiences with the phenomenon and bracketing out their views before proceeding with the experiences of others" (p.60). Accordingly, as a science educator and a resident of a New England city that struggles with student achievement and economic prosperity, the researcher's frame of reference is relevant to this study. First, the researcher seeks to support the educational improvement efforts of schools in small and mid-sized cities with economically disadvantaged students as well as schools in large urban communities. Although large urban centers have been the focus of many studies, smaller cities with economic need have received less attention. The ultimate goal of this research is to reveal ways to strengthen the schools in these high-need communities and foster positive student outcomes.

A second relevant aspect of the researcher's background derives from professional experience as a science teacher. Due to a propensity for scientific analysis, the researcher is more experienced with quantitative rather than qualitative approaches. However, the decision to apply mixed methods to this study stems from the researcher's intention to move beyond a quantitative analysis and summary of teacher's perceptions regarding their employment decisions. The qualitative component of this study enables the researcher to investigate why

retention and attrition factors affect teachers' decisions. Ultimately, an understanding of why particular factors influence teachers' career decisions can inform efforts to change school conditions in a productive way.

Finally, the researcher's experiences as a high school science teacher and science supervisor have contributed to her frame of reference. This study investigates the perspectives of high school science teachers regarding factors that influence their decisions to remain in or leave a teaching position. It also examines the conditions that school leaders can create to foster the retention of their science teachers. The teaching and leadership experiences of the researcher, which have spanned more than 30 years, may have influenced her interpretations of survey and interview data in this dissertation study. The researcher applied two methods to reduce the influence of bias on her interpretation of interview data. First, to assess reliability, one of three readers independently coded each interview. Second, to assess credibility, a focus group of interviewees reviewed and provided feedback on the researcher's summary of data. Each of these methods will be discussed in more detail later in this chapter. By bracketing her views and experiences, and by employing reliability and credibility measures, the researcher has attempted to mitigate the influences of bias, thereby allowing the survey and interview participants' perceptions to inform the development of the themes and conclusions of this study.

Participants

Survey participants. A purposeful sampling strategy (Creswell, 2007) was used to recruit participants from high school science departments in urban settings in New England. The population was limited to New England states for reasons of feasibility and the intent to apply findings locally as well as broadly. This study seeks to learn how science teachers can be retained in city schools that serve students of low socioeconomic status, where significant

attrition problems may be encountered (National Commission on Teaching and America's Future, 2003). Therefore, the schools selected for this study were those with 50% or more of their students receiving Free or Reduced-Price Lunch (FRPL).

The use of the term *urban* varies among publications, research studies, and programs. *Urban* sometimes refers specifically to America's largest cities. For example, in *Organizing Schools for Improvement*, Bryk and colleagues (2010) focus on the work of elementary schools in Chicago, a city of more than two million (United States Census Bureau, 2013), to evaluate conditions conducive to urban school improvement. The use of *urban* to describe large cities also occurs in *The Nation's Report Card: Science 2009 Trial Urban District Assessment.* This report of a National Assessment of Educational Progress (NAEP) trial study of urban schools focused on schools in the largest cities in the United States, those cities with a population of 250,000 or more (Institute of Education Sciences, 2011). By contrast, the term *urban* is sometimes used in reference to smaller communities. For example, for the 2010 census, the Federal Register provides the following definition of *urban areas*: "The term 'urban area' as used throughout this notice refers generically to urbanized areas of 50,000 or more population and urban clusters of at least 2,500 and less than 50,000 population" (United States Census Bureau Department of Commerce, 2011, p.2).

For the present study, *urban* is defined as cities and towns in New England that meet two criteria. First, each community falls under the designation of a *Large City*, *Midsize City*, *Small City*, or *Large Suburb* according to the National Center for Education Statistics (NCES). Table 3.1 provides definitions for each of these *Urban Locale* designations. The communities for this study were identified using the two most recent academic years (2009-2010 and 2010-2011) available through the NCES database (Institute of Education Sciences, 2012).

The second criterion used for the selection of high schools for the present study was that the school would have 50% or more of its students qualifying for the national Free and Reduced-Price Lunch (FRPL) program. The decision to use the FRPL status as a criterion for school selection in this study aligns with other studies and programs that have used indicators of low-income status to identify high need settings. For example, Teach for America, whose mission is to support the education of children in low-income communities, serves the city of Lawrence, Massachusetts ("City of Lawrence, Massachusetts," 2012), a city of less than 100,000. While the city of Lawrence is not a large urban community, its school district is one of high need.

Table 3.1 (Institute of Education Sciences, 2007)

Description of Locations used for School Selection

Locale	Definition
City	
Large	Territory inside an urbanized area and inside a principal city with population of 250,000 or more
Midsize	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000
Small	Territory inside an urbanized area and inside a principal city with population less than 100,000
Suburb	
Large	Territory outside a principal city and inside an urbanized area with population of 250,000 or more

Similarly, the Robert Noyce Scholarship Program at the University of Massachusetts, Dartmouth (UMD), a program that strives to recruit and support mathematics and science teachers in Southeastern Massachusetts, has selected its partner schools from low-income cities of less than 100,000, such as Fall River, Taunton, New Bedford, and Brockton (Hoey, 2008).

For the present study, schools in low-income communities were identified using the NCES database (Institute of Education Sciences, 2012). This online resource provides the number of students eligible for Free and Reduced Price Lunch and the total enrollment for each school. For this study, the percent FRPL for each school was calculated by dividing the number of FRPL-eligible students by the total school enrollment and multiplying by 100 (No. FRPL Students/Total Enrollment *100).

In summary, *urban* as used in the present study refers to schools in large, medium, and small cities and large suburbs in which 50% or more of the student body is eligible for FRPL. In the 129 schools that were identified for this study, FRPL-eligibility ranged between 50% and 100%. All schools in the study were public high schools, including charter and magnet schools. "High school" was defined as a school serving grades 9 – 12. Schools included in the study may have served grades 7 and 8 in addition to grades 9 - 12.

The initial recruitment process used the NCES 2009-2010 lists of New England schools in large, medium, and small cities and large suburbs with at least 50% of students eligible for the Free and Reduced Price Lunch program. Using these criteria, 105 schools were identified initially. Several approaches were used to contact as many of the science teachers in the identified schools as possible. To begin with, school district websites and department of education websites were used to build email address lists of superintendents and principals. Between October 10th and 12th, these lists were used to send school superintendents (38) and principals (72) e-mails to introduce the survey (Appendix C). This outreach was intended not only to introduce the dissertation study, but also to ask district and school leaders to forward the information to their high school science supervisors. Science supervisors, in turn, were asked to either respond with staff e-mail addresses or forward survey information to their science

teachers. Since one superintendent declined the initial survey invitation, the schools and teachers in that district were not contacted. This first round of e-mail communications garnered few responses and science teacher contacts. As of October 17th, 18 survey responses had been received.

As an alternative approach to contacting science teachers, the researcher built lists of teacher e-mail addresses by visiting schools' websites. For some schools, where teacher names were published without e-mail addresses, telephone calls were made to the schools to disseminate the invitations to teachers. In a few cases, current websites could not be located for schools.

In early November, while the process of building e-mail lists and contacting teachers continued, a review of the National Center for Education Statistics' website showed that data from the 2010-2011 academic year had been published. A comparison of the 2009-2010 and 2010-2011 New England schools in *Large*, *Medium*, and *Small Cities* and *Large Suburb* schools with at least 50% of students eligible for FRPL, revealed 24 additional schools for the study. School websites for these new sites were used to contact as many teachers as possible by e-mail.

Using both the 2009-2010 and 2010-2011 NCES databases produced a final list of 129 schools in Connecticut (33), Maine (3), Massachusetts (79) and Rhode Island (14). No high schools in New Hampshire or Vermont met the criteria for selection.

A different method of outreach was needed for teachers in 47 schools that did not provide e-mail addresses on the Internet. To invite those teachers, a contract was made with Market Data Retrieval (MDR), a commercial entity that maintains a national database of teacher e-mail addresses. The researcher supplied the e-mail invitation (Appendix D) and a list of the 47 schools

to MDR, which disseminated 174 e-mail invitations to science teachers in the designated schools.

A final effort to contact Massachusetts science teachers was made at the Massachusetts Association of Science Teachers conference, held in Boxborough, MA on November 16, 2012. The researcher prepared a display for the conference exhibit hall that included a list of MA high schools in the target population and information inviting survey participants. Five letters of invitation were taken from the display during the conference.

In summary, survey participants were recruited over a two-month period by e-mail. Follow-up reminder e-mails were sent to prospective participants several days after initial invitations were sent. Approximately 695 invitations were delivered to science teachers in the selected schools. Because of the extensive outreach employed during recruitment of participants, this number is thought to be a close approximation of the actual population size.

Interview participants. Forty-five teachers who completed the online survey, indicated their availability for an interview. Twenty-one of the interview volunteers were asked to complete an online consent form and schedule an interview. This purposeful sample was developed to reflect the diversity of years of experience, location (state), career status (first or second-career) and gender of the survey participants. The use of a purposeful sample of interviewees aligns with Maxwell's (2005) description of selecting a sample to "... adequately capture the heterogeneity of the group" (p. 89). The potential interviewees were asked by e-mail to complete an online consent form for the interview (Appendix E) and to indicate the preferred type(s) of interview (recorded conference call or recorded face-to-face interview) and suggest possible dates and times for interviews. Follow-up e-mails were sent to those who did not

respond to the initial invitation, and telephone contact was attempted for those who did not respond to the e-mails.

Of the 21 teachers invited for an interview, 16 completed consent forms. Four of those who completed consent forms were later unavailable for interviews, so 12 interviews were conducted.

Data Collection

Studies of teacher retention and attrition have employed quantitative, qualitative, and mixed methods approaches. Some quantitative studies have used published national data (e.g., Ingersoll, 2001), while others have derived data from surveys (e.g., Hughes, 2012; Boyd, Grossman, Ing, Lankford, Loeb, & Wyckoff, 2009). Interviews have provided data for qualitative studies (e.g., Johnson & Birkeland, 2003), and mixed methods studies have employed surveys and interviews (Curtis, 2011; Stevenson, Dantley, & Holcomb, 1999) to investigate teacher retention and attrition from a variety of perspectives. Several studies have investigated retention factors broadly, by examining a variety of variables that may influence teachers' career decisions (e.g., Alliance for Excellent Education, 2008), while others have assumed a focused investigation of specific variables, such as teacher commitment (e.g., Andrews & Donaldson, 2009) or school leadership factors (Angelle, 2006).

Instrumentation

Survey instrument. This dissertation study applies the knowledge gained through previously published studies to select particular factors and school conditions for study. The factors used are those that are amenable to modifications at the school leadership level and which have been shown to have a strong influence on teacher turnover. The primary factors addressed in this study are school leadership, professional community, and mentor programs. The survey

also included four items that addressed induction programs and professional autonomy. Because the study focuses on high school science teachers, the survey instrument also addressed factors that may be of particular import for this discipline, such as laboratory safety and the availability of laboratory supplies and equipment.

Quantitative data were obtained through an online survey (Appendix A) hosted on SurveyMonkey from October 11 through December 3, 2012. The first page of the survey consisted of the *Consent to Participate*; an affirmative response led participants to begin the four-part survey. The first survey section obtained information about participants' teaching experience and their career status. Parts 2 and 3 consisted of ranking items addressing potential retention factors and attrition factors, respectively. Each item included a *Comment* section for teachers' additional explanations or reflections about the item. Participants ranked each item according to its perceived level of significance, using a 1 – 7 response scale, where 1 designated *No Significance*, and 7 indicated *Very Significant*. In Part 2 of the survey, teachers could also select *N/A* (*Not Applicable*) for any factor that had not been part of their experience in their current high school setting.

Opinions vary regarding the appropriate number of survey response alternatives using a Likert-type scale (Cox, 1980; Weng, 2004). Studies have investigated the effects of the number of responses on validity and reliability (Cox, 1980; Weng, 2004). Rating scales using between five and nine response choices have been described as reasonable (Cox, 1980). Furthermore, Cox (1980) has suggested:

> …an odd rather than an even number of response alternatives is preferable under circumstances in which the respondent can legitimately adopt a neutral position. Overuse

of the neutral category by respondents can generally be avoided by providing them with an adequate number of reasonable response alternatives. (p.420)

In the present study, teachers used a 1 – 7 scale to rate the significance of retention factors (Part 2) and attrition factors (Part 3). In this study, the scale of 1 – 7 was used to provide for higher resolution of perceived significance than a scale with fewer response options might provide. Because this study also seeks to differentiate between first-career and second-career science teachers' views on retention and attrition factors, the 1 – 7 scale may to help identify subtle differences between these two populations of teachers.

Parts 2 and 3 of the survey were developed as mirror images regarding the factors under study. While Part 2 addressed positive conditions for each factor, Part 3 addressed the negative counterparts of these factors. Participants were asked to rank the significance (1-7) of various negative conditions on their decisions to leave a teaching position or to leave the profession. This section of the survey was designed to accommodate the effects of negativity bias, which is the phenomenon whereby negative stimuli, occurrences, objects, and characteristics have greater import than do their positive counterparts (Hilbig, 2009; Rozin & Royzman, 2001). Considering the literature on negativity bias, it seemed probable that this phenomenon would affect teachers' evaluation of the significance of attrition factors. A variety of effects of negativity bias has been described (Rozin & Royzman, 2001). For example, Hilbig's (2009) study of the influence of negativity bias on individuals' perception of truth revealed that information presented in a negative frame is judged more valid than the same information presented with positive framing. This finding, which occurred with experimental controls for participants' optimistic or pessimistic dispositions, has direct applications to the present study. Teachers might perceive some negative conditions and experiences more strongly than they would perceive their positive

counterparts. Negativity bias might lead to stronger judgments of the validity of those negative experiences and generate a higher propensity to leave a position or career. Because the items in Part 3 of the survey were presented as hypothetical conditions, the *Not Applicable* response was not offered.

Parts 2 and 3 of the survey each consisted of 23 ranking items, for a total of 46 items. Two open response items followed Part 3 for teachers to describe conditions, not addressed in the study, which influenced their retention or attrition decisions.

As shown in Table 3.2, category items in Parts 2 and 3 of the survey were interspersed to reduce the influence of question sequence on participants' responses.

Table 3.2

Survey Items by Category of Retention and Attrition Factors

Category	Retention Items	Attrition Items
Leadership	9,10,16,19,20,21,31	32,33,35,36,42,43,44,54
Professional Community	11,13,15,17,24,27,28	34,37,40,47,50,51
Mentor Program	18,23,25,26	38,46,48,49
Science Factors	12,14,30	39,41,53
Induction Program	22	45
Autonomy	29	52

Part 4 of the survey consisted of items that addressed demographic information, certification status, and teachers' level of commitment. In addition, this section offered participants the opportunity to volunteer for an interview and to request a summary of the study's results.

Interviews. Within the on-line survey, participants could volunteer for a follow-up interview (Appendix B). The semi-structured interviews ranged from approximately 18 to 45

minutes; each was digitally recorded. With the exception of one face-to-face interview, conducted at a local community college, telephone calls were used for interviews. Each interview was assigned a reference number that corresponded to interviewee's number of years in his or her current position, career status (first or second-career), gender, and interview number. To maintain anonymity of the interviewees, only the interview reference number identified the audio files for transcription and coding.

Interview questions were developed to address the following objectives:

- reveal motivations for teachers' career path decisions
- describe teachers' perceptions regarding teaching in an urban school environment
- identify factors that influence teachers' commitment to a particular urban school
- describe teachers' perceptions of school conditions that affect their employment decisions
- discern particular attributes of leadership conditions and practices that teachers perceive as significantly affecting their employment decisions
- provide an open format for teachers to discuss factors they perceive as significant influences on their employment decisions

Management of Data Analysis

Figure 3.1 displays the framework of data analysis used for each of the research questions in this study. In the following section, the methods of quantitative data analysis are described for each research question. Next, the process of qualitative data analysis is discussed, and Figure 3.2 is presented to summarize that process. Finally, qualitative data analysis is discussed for each research question.

Quantitative data. While acknowledging disagreement among some researchers regarding the calculation of a mean with ordinal data (Denscombe, 2011), the researcher chose to treat the survey data from this study as interval levels of measurement (Salkind, 2011). Therefore, the mean significance value was calculated for categories of retention factors (Part 2) and attrition factors (Part 3). In this study, the mean provides a measure of central tendency of teachers' perceptions of the degree of significance of particular factors. All quantitative data analysis was completed using Microsoft Excel 2010 and SPSS v20.0 software.

The first guiding question for this study is, "What are the conditions necessary to retain new science teachers in urban area high schools?" Survey data are analyzed in three ways to address this question. As illustrated in Figure 3.1, the first analysis compares teachers' rankings of the various retention and attrition factors. Because the multi-item categories of retention and attrition factors used in this study contain different numbers of items, a common metric was developed to allow comparisons among categories and items. To determine the relative importance of the categories of retention and attrition factors, the percent of total possible points was determined for the retention and attrition categories of *School Leadership*, *Professional Community*, *Mentor Programs*, and *Science Factors*. Similarly, the percent of total possible points was calculated for the retention and attrition factors of *Induction Programs* and *Autonomy*. The researcher acknowledges the reliability and validity limitations of individual items on a Likert-type survey (Gliem & Gliem, 2003). However, these factors are examined to estimate science teachers' perceived importance of these factors relative to the major categories under study.

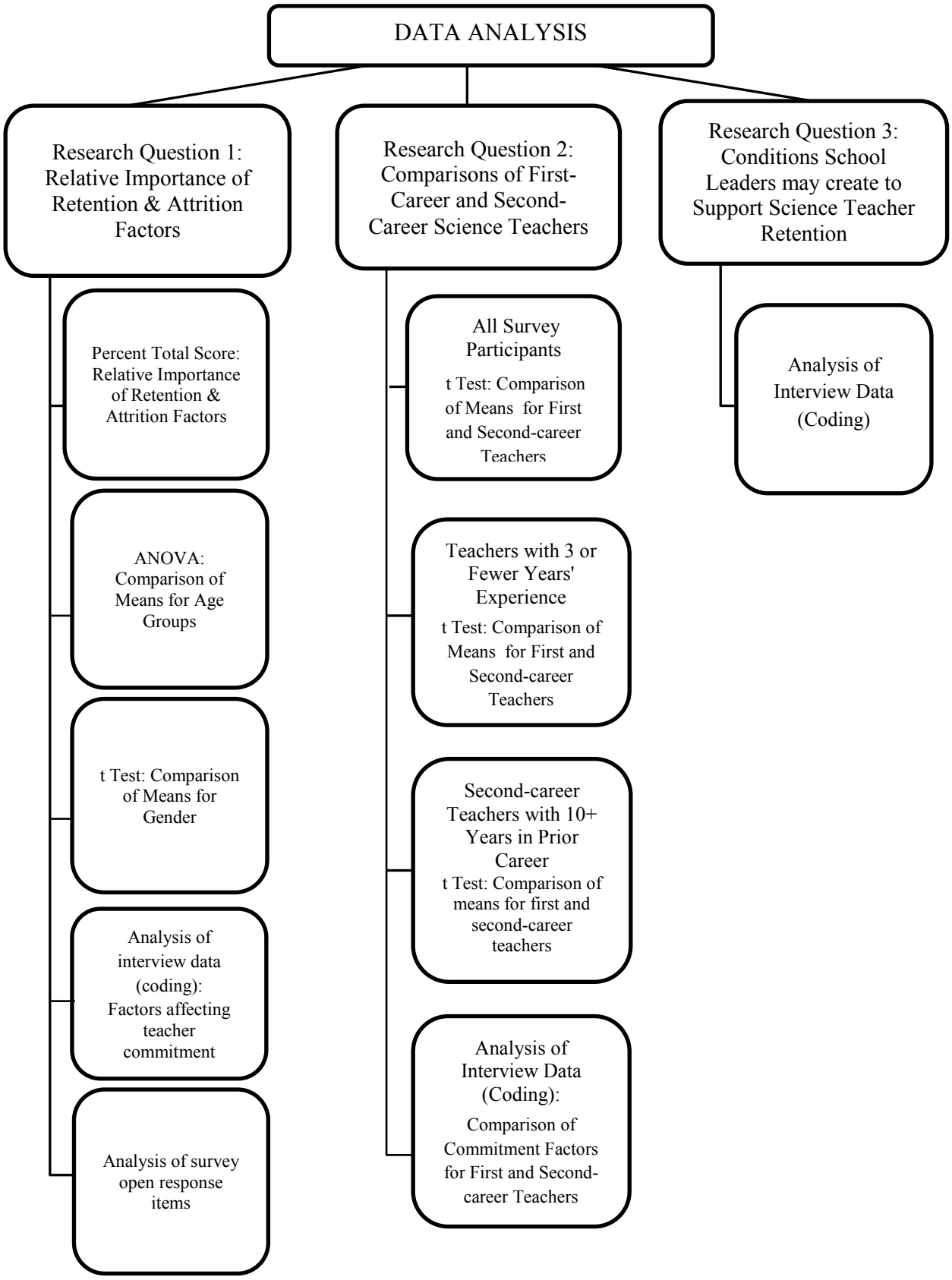

Figure 3.1. Framework for data analysis.

The first step to calculating the percent total score for categories of retention and attrition factors was to add respondents' rating scores for each item answered within each category. Next, all respondents' rating scores for all items within a category were added to determine the total points respondents assigned to each category. Next, the maximum number of points possible for each category was determined by counting the respondents for each question and multiplying that number by 7 (the maximum possible score for each item). *Not Applicable* and skipped questions were not counted. Finally, the percent total score was determined by dividing the total points assigned by respondents for each category by the total points possible for that category. A similar procedure was used for determining the percent total score for the individual survey items regarding induction programs and autonomy. The percent total score calculated for multi-item categories of factors and for individual survey items serves as a common metric for comparing the relative importance of retention and attrition factors.

Two additional analyses are used to investigate the importance of retention and attrition factors. Age and gender are examined for their relationship to perceived significance of retention and attrition factors. A one-way test of variance (ANOVA) (Salkind, 2011) is used to compare perceptions among different age groups, and a *t* test (Salkind, 2011) is used to investigate the perceptions of females and males.

The second guiding question for this study is, "What are the similarities and differences in retention-promoting factors and attrition factors between first-career and second-career science teachers?" Three analyses are used to determine whether career status (first-career vs. second-career) influences teachers' perceptions of retention and attrition factors. The first analysis uses a *t* test to compare the perceptions of all first-career and second-career survey participants. The second analysis is limited to teachers within their first three years in a position.

For this subset of participants, the mean responses of first-career and second-career teachers are compared using a *t* test. Finally, a *t* test analysis is used to compare the mean responses of all first-career teachers with the mean responses of second-career teachers who had completed 10 or more years in a prior career. Each of these analyses uses participants' mean responses to the categories of retention and attrition factors and to the survey items that addressed induction programs and autonomy.

Qualitative data. Both the open-response items at the end of Part 3 of the online survey and 12 teacher interviews provide qualitative data for this study. The data from the interviews are used to enrich understandings of the influence and significance of various factors on science teacher retention and attrition. Interview responses also identify factors that affect teachers' career path decisions, themes that explain their levels of commitment, and conditions that school leaders can create to support science teacher retention. Figure 3.2 illustrates the researcher's method of interview data analysis.

Denscombe (2010) explains that the grounded theory approach to data analysis "… requires a detailed scrutiny of the text and involves a gradual process of coding and categorizing the data. The ultimate goal of the analysis is to derive concepts and theories that capture the meaning contained within the data" (p.283). The present study seeks to understand how the experiences of first-career and second-career science teachers contribute to their decisions to remain in a position or seek an alternative placement. Data analysis for this study involved coding and the development of categories for organizing codes.

The process of coding used for the analysis of interviews in this study aligns with Denscombe's (2010) description of " … the 'data analysis spiral' which means that each task is likely to be revisited on more than one occasion as the codes, categories and concepts get

developed and refined" (p.286). The iterative process of data analysis began by reviewing interview transcripts while listening to the audio files. As shown in Figure 3.2, the process of creating codes started during this review as well. Initially, code categories corresponded to the interview questions. After the transcripts had been checked for accuracy, coding began for each of the 12 transcripts, using QDA Miner 4 Lite, an online data analysis tool. During the process of coding, new codes were added, and the code list was reviewed and edited. Editing involved merging redundant codes, revising some codes for clarity, and adjusting the organization of the codebook. New categories were created that reflected themes emerging from the interviewees' descriptions of factors that contributed to or detracted from their commitment to their job or their setting. A working map of the categories, subcategories, and codes was developed to facilitate this interpretive analysis. As codes were organized into categories, additional modifications were made to the codes to improve clarity. Finally, codes and categories were adjusted in QDA Miner 4 Lite and coded transcripts were modified accordingly.

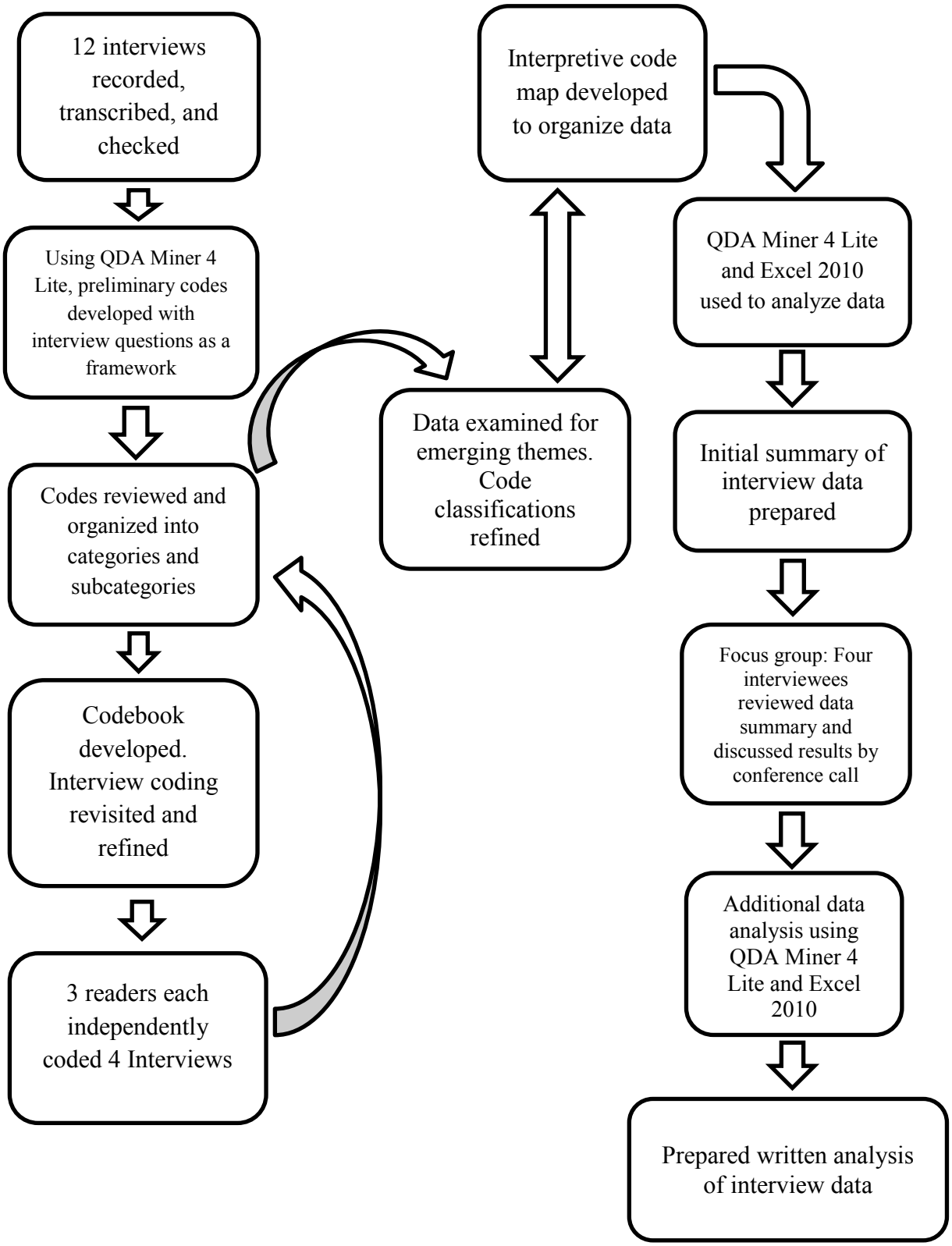

Figure 3.2. Process of interview data analysis.

As illustrated in Figure 3.2, once the codebook revisions had been completed, three educators, who had been introduced to the coding process for this study, were recruited to analyze four of the 12 interviews. Each coder independently analyzed a different subset of the 12 interviews, so that the researcher could consider others' interpretations and assess the reliability of her codings for each interview. Using Microsoft Word or printed copies of the codebook and interview transcripts, these educators assigned codes by marking either the code number or a written phrase beside relevant interview content. Next, the researcher reviewed these coded transcripts, comparing them to the researcher's original coded transcripts. Figure 3.2 illustrates the beginning of this iterative review of code assignments with an upturned arrow. During this review, the researcher recorded coding agreements and evaluated segments where code assignments differed. The researcher made additional modifications to her original coding when necessary, such as adjusting codes to reflect the readers' input or collapsing two codes into one. This occurred, for example, when segments coded *Issues with Student Discipline* were subsumed under the code *Negative School Climate*.

Upon completion of coding and additional adjustments to the code map, the researcher used QDA Miner 4 Lite to analyze the 12 interviews. Coding frequencies were reviewed for the full interview sample and for the subsets of first-career and second-career educators. Denscombe (2010) has explained that:

> In principle, grounded theory analysis aims to use the higher level codes and categories as the basis for identifying key concepts. … The development of these concepts is the main purpose of the analysis because the concepts provide some new understanding of the data and constitute the foundations for any theory or general conclusions to emerge from the research. (p. 286-287)

Analysis of code and case (interviewee) frequencies facilitated the identification of important concepts in the data regarding science teacher retention. As shown in Figure 3.1, Research Question 1 is addressed with interview data analyzed regarding factors that affect the commitment of teachers. For Research Question 2, the researcher compares the responses of first-career and second-career teachers using case (interviewee) frequencies for code categories and subcategories for the two groups. Finally, for Research Question 3, interviewees' recommendations regarding conditions school leaders may create to foster teacher retention are analyzed using code and case (interviewee) frequencies.

The online survey included two open-response items that gave respondents the opportunity to describe retention and attrition factors that had not been part of the survey. As shown in Figure 3.1, these open-response items provided data for Research Question 1. Teacher responses to the open-response items were relatively brief statements about retention and attrition factors. Because these responses tended to be less complex than interview data, the researcher used a process of text analysis provided by SurveyMonkey to code the responses. All responses were reviewed, and categories that reflected their content were established. Thirty codes were used to categorize responses to the first item (retention factors), and 35 codes were used to categorize responses to the second item (attrition factors). Nearly all of the coding categories corresponded to interview coding categories, such as *Altruism*, *Professional Autonomy*, *Authoritarian Leadership Style*, *Intrinsic Rewards*, and *Camaraderie*. However, two open-response item codes, *Lack of Opportunity for Advancement* and *Work Day/Work Year*, were not used as interview codes because interviewees did not discuss these factors.

Validity and Reliability

Triangulation of data is a recommended approach for reducing validity threats (Denscombe, 2010; Maxwell, 2005). Denscombe (2010) has explained the rationale behind triangulation: "The principle behind this is that the researcher can get a better understanding of the thing that is being investigated if he/she views it from different positions" (p.346). The mixed methods approach employed in this study supports validity through triangulation. Quantitative data, derived from the online survey, as well as qualitative data, derived from interviews and open response survey questions, contribute to a richer understanding of teachers' perceptions regarding retention and attrition.

Survey. The development of items for the retention (Part 2) and attrition (Part 3) sections of the survey was informed by the literature. As a measure of the instrument's validity, Table 3.3 illustrates sources of information for a sample of survey items. Appendix F presents this information for all survey items.

Pilot study. A small pilot study of the survey was conducted from September 27 – October 12 in a New England high school that was not part of the study population. The pilot study served to test the items and format of the survey instrument. During the pilot study, the survey items and pages that addressed retention and attrition factors (Parts 2 and 3, respectively) were randomized for successive participants. Randomization was used to reduce the potential effects of item sequence on respondents' answers.

Seventeen teachers took the pilot survey once, and five teachers took the survey a second time, approximately one week later. Test-retest reliability was measured using the responses of the five teachers who took the survey twice.

Table 3.3

Grounding of Survey Items in Teacher Retention Literature – Sample Items

Survey Item	Reference	Relevant Content
9. Feeling valued and respected by my school principal	Finnegan, 2010	"My supervisor sets aside time just for me and believes my opinions are important" (p. 106).
	Certo & Fox 2002	"Their comments evidenced that they defined school-level administration support as policies or practices present that supported teacher work and created an environment that treated teachers as professionals" (p. 7).
12. Having adequate supplies and attention to laboratory safety	Certo & Fox, 2002	"Instructional materials and functional, current technology were described by focus group teachers as inadequate, and as a reason for teachers leaving…" (p. 11). "Some teachers … felt that building level administration did not provide the resources and supplies needed by teachers" (p.13).
21. Receiving an orientation or induction program during my first year at this school	Alliance for Excellent Education, 2008	Regarding methods to promote teacher retention in hard-to-staff schools: "Comprehensive induction, a program that includes varying degrees of training, support, and assessment during a teacher's first years on the job, proves most effective" (p.5).
42. Feeling unsafe at school due to student behavior or discipline issues	Johnson & Birkeland, 2003	Regarding teachers who voluntarily moved to new schools or districts within three years: "They left schools where student disrespect and disruption were taken for granted as inevitable and moved to schools that had well-established norms of respect, effective discipline systems, and deliberate approaches to parental involvement" (p. 598). Reported by Settled Stayers: "safe, orderly environments" (p. 603)

The pilot study confirmed that the SurveyMonkey instrument performed as desired without technical problems. To improve clarity, minor changes in the wording of a few survey items were made prior to the administration of the dissertation survey. Additionally, the placement of the *Not Applicable* choice for items in Part 2 of the survey was modified for the

dissertation study. Whereas the pilot study offered the *Not Applicable* response at the beginning of each survey page, the response was repeated for each item in Part 2 for the dissertation study. This change was made to remind participants that the *Not Applicable* response should be selected whenever they had not experienced a particular factor in their school setting.

Pearson's correlation coefficient was calculated for the two administrations of Parts 2 and 3 of the survey that had been completed by five participants in the pilot study. The correlation coefficient for Parts 2 and 3 combined was 0.92; for survey items in Part 2 (retention factors), r = 0.90, and for survey items in Part 3 (attrition factors), r = 0.85.

Internal consistency reliability is a measure of the degree to which different survey items measure the same construct (Salkind, 2011). The pilot survey items within the *Leadership*, *Professional Community*, *Mentor Program*, and *Science Factors* categories were tested for internal consistency reliability using Cronbach's alpha. As shown in Table 3.4, the obtained values show acceptable reliability for the eight categories, with alpha varying from .774 for *Leadership* retention factors to .940 for *Mentor Program* retention factors.

Table 3.4

Pilot Study Internal Consistency Analysis

Category	Retention Factors			Attrition Factors		
	Number of Items	**Cronbach's alpha**	**N**	**Number of Items**	**Cronbach's alpha**	**N**
Leadership	7	.774	14	8	.832	13
Professional Community	7	.869	14	6	.871	13
Mentor Program	4	.940	14	4	.931	13
Science Factors	3	.776	14	3	.827	13

Due to an error in manipulating the online survey software, survey items and pages in Parts 2 and 3 of the survey were not randomized for the dissertation research. However, there is reason to believe that the sequence of the survey items and pages did not affect participants' responses significantly. For example, the test-retest reliability results from the pilot survey, which had item and page randomization, were good: 0.92 for Parts 2 and 3 of the pilot survey. Furthermore, as shown in Table 3.4, the internal consistency results for the pilot survey were acceptable. These observations suggest that the sequence of survey items and pages did not affect participants' responses significantly. As an additional check on reliability, Table 3.5 shows the results of internal consistency calculations for the dissertation survey.

Notwithstanding the loss of randomization of items and pages in the dissertation survey, the internal consistency reliability of the multi-item categories remained acceptable, ranging from .757 for *Science Factors* for attrition to .931 for *Mentor Program* retention factors.

Table 3.5

Dissertation Survey Internal Consistency Analysis

	Retention Factors			**Attrition Factors**		
Category	**Number of Items**	**Cronbach's alpha**	**N**	**Number of Items**	**Cronbach's alpha**	**N**
Leadership	7	.861	100	8	.875	117
Professional Community	7	.883	101	6	.875	117
Mentor Program	4	.931	48	4	.863	117
Science Factors	3	.869	107	3	.757	117

Note: The variations in N for Retention Factors reflect the number of "not applicable" responses in each category.

Interviews. As a reliability measure, three educators, who had been introduced to the coding process for this study, each coded four of the interviews as a way for the researcher to consider others' interpretations and assess reliability. Their review of four transcripts was done independently of each other and the researcher. Using Microsoft Word or hard copies of the codebook and interview transcripts, these educators assigned codes by marking either the code number or a written phrase beside relevant interview content. Next, the researcher reviewed these coded transcripts, comparing them to the researcher's original coded transcripts. Points of agreement were noted and places where coding differed were evaluated for accuracy. As these coded transcripts were reviewed, additional modifications to codes were made when necessary. For example, in a few cases two codes in a category needed to be collapsed into one code.

Involving participants in the analysis and interpretation of qualitative research has been described as an approach to support the credibility of a study's findings (Denscombe, 2010; Glesne, 1999). Glesne (1999) has highlighted the benefits of member checking in qualitative research in this way, "By sharing working drafts, both researcher and researched may grow in their interpretations of the phenomena around them" (p.152). Accordingly, to enhance the credibility of this dissertation study's findings, a focus group of interviewees reviewed a summary of the interview data. The researcher sent the data summary, as an e-mail attachment, to the focus group volunteers, who were invited to provide written feedback or participate in a conference call. Although seven interviewees had volunteered for this data review when they completed the interview consent form (Appendix E), four teachers, two females and two males, were able to participate in the focus group conference call. During the 87-minute conference, the three career-changers and one first-career teacher discussed the study's findings, sharing their perspectives with each other and with the researcher. The conference confirmed the summary

findings. The focus group participants also conveyed consensus about the importance of colleagues' motivation and dedication as conditions affecting a teacher's commitment, which the researcher subsequently included in the data analysis.

Limitations

A purposeful sample was used for this study in order to examine teacher retention issues in an academic discipline (science) and setting (urban schools with high need populations) known to face high rates of teacher turnover. Outreach to these schools in New England was extensive and generated a survey participation rate of nearly 20 percent (138 survey participants/695 email invitations). The researcher acknowledges that responses of the study's voluntary participants could differ from teachers who did not read the e-mail invitations or who chose not to participate. Furthermore, since the study is limited geographically to New England, the perceptions of science teachers from these high schools might not reflect the views of teachers from other regions.

With the exception of one face-to-face off-site interview, all interviews were conducted by telephone call. Therefore, the qualitative analysis does not include contextual information derived from observations. The researcher also acknowledges the limitations of interviewing as described by Maxwell (2005): "(interviewing) …gives you a description of what the informant *said*, not a direct understanding of his or her perspective" (p.94).

The 12 teachers who were interviewed represent a variety of the characteristics of the total population, including percent females and males, career status, the state in which they teach, years in a position, and intended years to remain in a position. The researcher acknowledges that the opinions and statements of interviewees might not be representative of the entire population.

Rather, the information they shared during interviews helps to explain factors that affect some science educators in urban settings.

The researcher acknowledges that the wording of some survey items may have inadvertently affected the responses of participants. Similarly, some interview questions may have influenced participants' responses to subsequent questions. Furthermore, teachers' participation in the survey may have influenced their thinking about their school experiences and thereby affected their responses to interview questions.

Summary

This descriptive study uses an explanatory mixed methods approach (Denscombe, 2010) to investigate factors affecting the retention of science teachers in urban area high schools where 50% or more of students qualified for the Free and Reduced-Price Lunch program. The objectives of this study are to assess differences in retention and attrition factors among first-career and second-career science teachers and to explore the conditions that school leaders can establish to promote the retention of science teachers. Data were collected from science teachers through a voluntary online survey and through follow-up interviews with a subset of survey participants. Data were analyzed with Microsoft Excel 2010, SPSS v.20.0, and QDA Miner 4 Lite. The next chapter presents the study's results and their analysis.

CHAPTER FOUR: ANALYSIS OF DATA

This chapter presents the analysis of the survey and interview data in three main sections. The first section describes the survey and interview participants. Characteristics of the survey participants are described to provide a general picture of the population of science teachers involved in the study. In addition to gender and career status, the description of participants includes their years of employment in their current positions, their plans to remain in their positions, whether they have worked in other schools or districts, and their level of commitment to an urban setting. Interview data are used to describe participants' reasons for entering the teaching profession and their perceptions about teaching in an urban environment.

The second section of this chapter addresses the reliability of the survey data. It begins with a summary of the response rates, and corresponding margins of error, for the parts of the survey (Parts 2 and 3, respectively) that address retention and attrition factors. Next, an outline of the survey items in Parts 2 and 3 of the survey is provided (Figures 4.9 and 4.10), and the internal reliability results for categories of survey items are given.

The third section of this chapter presents the analysis of survey and interview data. The guiding questions for the study provide the framework for the discussion of both quantitative and qualitative results. The first research question addresses the retention and attrition factors identified in the study. Therefore, the analysis begins by determining the relative importance of retention and attrition factors as measured by the online survey. To examine retention and attrition factors with respect to subsets of the participants, retention and attrition factors are compared between genders. Finally, the survey responses of groups of teachers based on their age groups (<30, 30-39, 40-49, ≥ 50 years) are compared by an analysis of variance (ANOVA). The analysis of quantitative data is followed by an examination of survey respondents' answers

to two open-response questions and data derived from interviews. In this way, the factors revealed through the quantitative aspect of the study (online survey) are compared with the findings from the qualitative components (open-response survey items and interviews).

The second research question of this study seeks to compare first-career and second-career teachers' perceptions of retention and attrition factors. Both survey data and interview findings are used to compare the perceptions of these two subgroups of teachers. To begin with, the results derived from Parts 2 and 3 of the survey are compared for all first-career and second-career participants. Next, to examine the perceptions of teachers who are most influenced by retention and attrition factors in their current positions, the survey responses of first and second-career teachers who have been in their present teaching position for three years or less are compared. A third analysis of survey data investigates whether the number of years in a prior career affects the perceptions of second-career teachers relative to retention and attrition factors. To study this sub-group of second-career teachers, the survey responses of all first-career teachers are compared with the survey responses of second-career teachers who have had 10 or more years of experience in a prior career. Finally, interview findings are discussed regarding the perceptions of first-career and second-career teachers.

The third guiding question of this study focuses on the conditions that school leaders can create to promote science teacher retention in urban area schools. To address this question, the suggestions offered by interviewees are described. During this discussion, the perspectives of first-career and second-career science teachers are noted, as well.

The chapter concludes with a summary of the analysis framework and the study's major findings.

Participants

Survey participants. Most of the 113 teachers who completed demographic survey items were females (60.2%), while 39.8% were males. Figure 4.1 illustrates that approximately half of the participants (49.5%) were 39 or younger, nearly 16% were between 40 and 49 years old, and 34.5% were 50 or older. Table G1 in Appendix G lists the demographic data for survey participants.

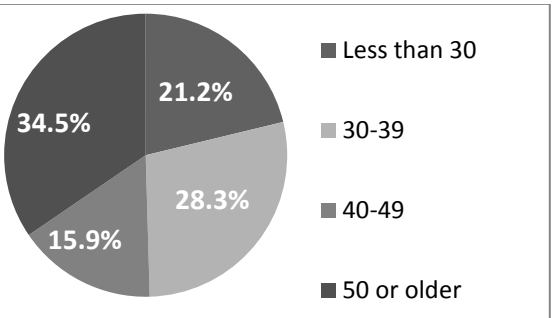

Figure 4.1. Age categories of survey participants.

Figure 4.2 provides information about the employment history of the participants. Approximately 10% of the survey participants were in their first year in their present teaching position. Nearly 21% had been in their current position between 2 and 4 years, while 70% of the survey respondents had been in their current teaching position for 5 or more years. Table G2 in Appendix G provides the data that correspond to Figure 4.2.

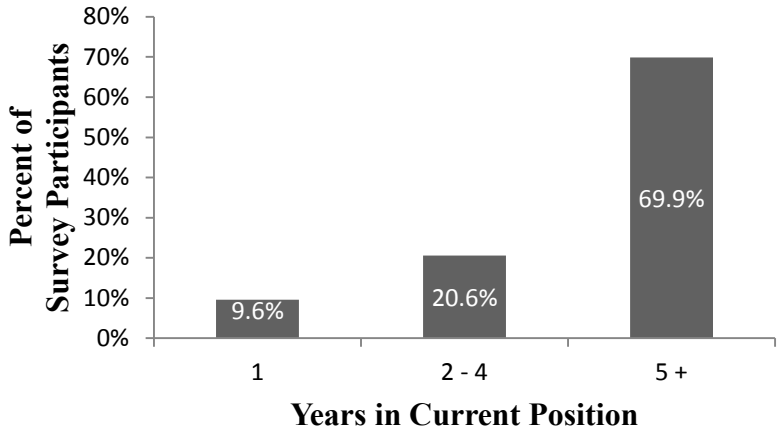

Figure 4.2. Survey participants' number of years in their current teaching position.

Participants were asked to state the time they intended to remain in their current positions. Table G2 in Appendix G provides the data used for Figure 4.3, which illustrates that nearly 53% of the participants indicated that they plan to remain in their current positions for 5 or more years. However, 25% indicated that they plan to stay for 2 years or less, and another 22.1% stated they plan to stay for three to five years. These results, which suggest that approximately 47% of the participants may leave their positions within the next five years, reveal potential turnover among the participants and illustrate the need for ongoing recruitment and retention efforts.

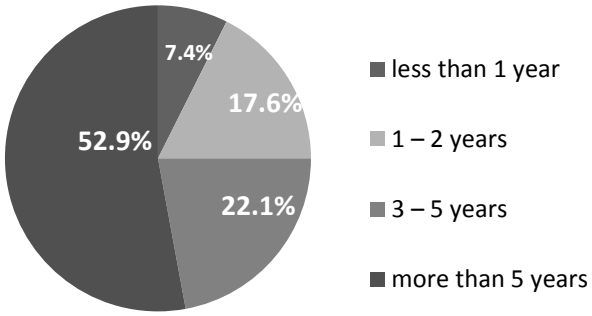

Figure 4.3. Intended time to remain in current teaching position.

Teachers' projections regarding the time they intended to remain in a position were examined more closely to identify patterns of projected leaving with number of years in a position. The group of teachers, who indicated that they planned to stay for 5 years or less, was disaggregated according to the number of years they had completed in their current positions, and the results are shown in Table 4.1. Among teachers who had been in a position for three years or less, 60% plan to leave in five years or less, while 43.5% of teachers with seven or more years in their current position, plan to leave in five years or less. Teachers with 4 – 6 years in a position were least likely to leave in 5 years or less (40.6%)

Table 4.1

Intent to Leave a Position within Five Years Based on Years in a Position

Years in Position	Number Who Plan to Stay 5 Years or Less	Number of Teachers	Percent Planning to Stay 5 years or less
1-3	21	35	60%
4-6	13	32	40.6%
$\geq$ 7	30	69	43.5%

Figure 4.4 illustrates the pattern of intent to leave a position within five years based upon survey results. The general pattern of these data resembles the bimodal curve of teacher attrition described by Grissmer and Kirby (1987). The pattern reveals that the highest turnover rates occur early and late in a teacher's career.

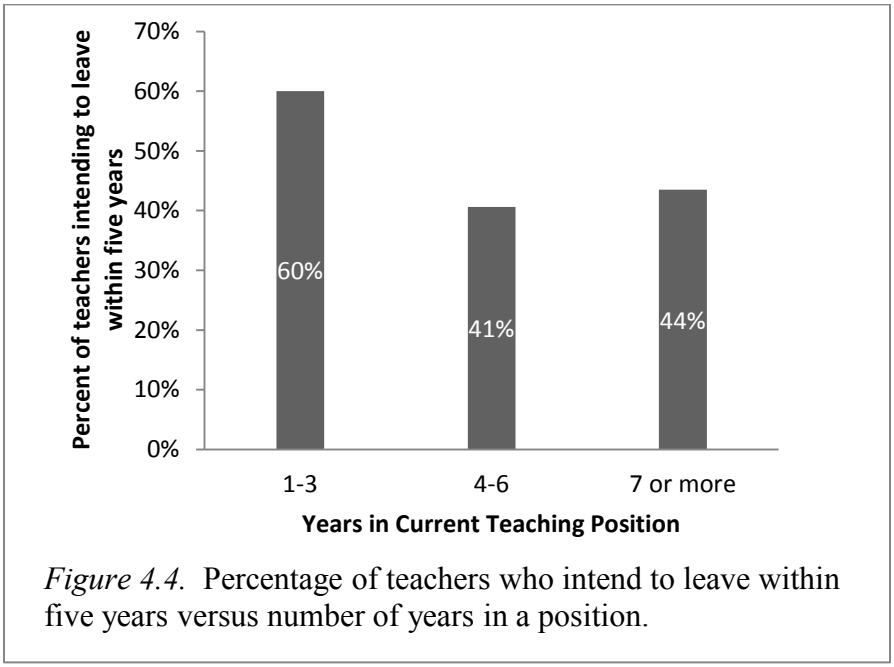

Figure 4.4. Percentage of teachers who intend to leave within five years versus number of years in a position.

Survey participants also indicated whether they had taught in one or more other schools or districts prior to their present positions; their responses are provided in Table G2. Figure 4.5 shows that nearly 49% of the survey participants had been employed in other schools or districts prior to their current positions. This response rate suggests a pattern of teacher turnover within this population. Additionally, it raises the question whether individuals in their first teaching position might show a higher attrition rate than those with prior teaching experience. To answer this question, the two groups of teachers were compared using those survey participants who were in the early years of employment (4 years or less) in their current position. Table 4.2 compares teachers' intent to remain in their current position for early career teachers who lacked prior teaching experience with those who had taught previously.

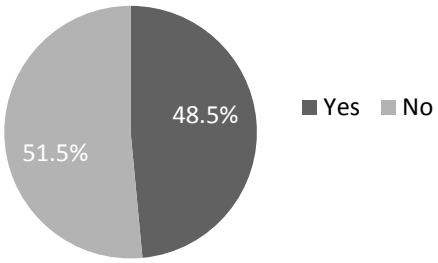

Figure 4.5. Survey participants with prior teaching experience in other schools or districts.

Table 4.2

Comparison of Teachers with Less than Five Years in Current Position Regarding Intent to Stay

	Never Taught Elsewhere		Previous Teaching Experience	
Intended Years to Stay	Number	Percent	Number	Percent
< 1 year	5	25.0%	0	0.0%
1 - 2 years	2	10.0%	3	14.3%
3 - 5 years	8	40.0%	7	33.3%
5 Years +	5	25.0%	11	52.4%
Total Teachers	20	100.0%	21	100.0%

The results shown in Table 4.2, which focuses on teachers in their first four years in a school, illustrate that 25% of the respondents who lacked prior teaching experience intended to remain in their current positions for less than one year. By contrast, none of the experienced teachers intended to leave within one year. Furthermore, while 75.0% of the survey participants who lacked prior teaching experience intended to remain in their positions for five years or less, 47.6% of the experienced teachers intended to leave within 5 years. Although these data do not represent actual attrition rates, the responses of early career teachers summarized in Table 4.2 suggest higher turnover rates among teachers who are new to the profession than among those with some prior experience.

Interview participants. Twelve teachers were interviewed for the qualitative component of this study. Tables 4.3 through 4.7 list the characteristics of the interviewees, the forty-five interview volunteers, and those who did not volunteer for an interview. The characteristics of these three groups of teachers are juxtaposed to facilitate their comparisons.

Interviewee characteristics. Table 4.3 compares the composition of the interviewees, all interview volunteers, and interview non-volunteers with respect to gender composition, career status, and prior teaching experience. In terms of gender, the group of interviewees represents a similar composition to both the interview volunteers and to those who did not volunteer. Most of the interview volunteers were second-career educators (54%), and this is reflected in the sample of interviewees as well (58% second-career). Among those who did not volunteer for an interview, most were first-career teachers (55%). With regard to prior teaching experience in one or more other schools or districts, interviewees were equally divided. While most interview volunteers (53%) had taught in other schools, most of those who did not volunteer for an interview (56%) had not taught in another school or district.

Table 4.3

Gender, Career Status, and Prior Teaching Experience of Interviewees, Interview Volunteers, and Non-volunteers

	Gender		Career Status		Prior Teaching in Another School or	
	Female	Male	First Career	Second Career	Yes	No
Interviewees	7 (58%)	5 (42%)	5 (42%)	7 (58%)	6 (50%)	6 (50%)
Interview Volunteers	28 (62%)	17 (38%)	16 (36%)	29 (54%)	24 (53%)	21 (47%)
Non-Volunteers	40 (59%)	28 (41%)	50 (55%)	41 (45%)	42 (44%)	53 (56%)

Table 4.4 compares the states represented by interviewees, interview volunteers, and those who did not volunteer for an interview. Interviewees show a close approximation of the states represented by all interview volunteers. A comparison of interview volunteers and non-volunteers reveals that 29 teachers, approximately 31% of those who did not volunteer for an interview, did not identify the state where they worked. An effort was made to have at least one representative from each of the participating states in the sample of interviewees. Since Massachusetts had the highest number of survey participants and interview volunteers, the majority of interviewees are from that state.

Table 4.4

Location by State of Interviewees, Interview Volunteers, and Non-volunteers.

	State				
	CT	ME	MA	RI	Not Identified
Interviewees	3 (25%)	1 (8%)	7 (58%)	1 (8%)	X
Interview Volunteers	8 (18%)	1 (2%)	33 (73%)	3 (7%)	X
Non-Volunteers	16 (17%)	3 (3%)	45 (47%)	2 (2%)	29 (31%)

Interviewees were selected to represent a variety of years' experience in their current positions, with greater emphasis on teachers in their first three years in a position. Therefore, as shown in Table 4.5, 33% of interviewees were in their first three years in their positions, compared to 18% of interview volunteers, and 30% of non-volunteers. The selection of interviewees was skewed to the early years of employment to gather perceptions of those who were more likely to be currently affected by retention factors in schools.

Table 4.5

Years in Current Teaching Position for Interviewees, Interview Volunteers and Non-Volunteers

	Years in Current Position						
	1	2	3	4	5	6	7 or more
Interviewees	2 (17%)	1 (8%)	1 (8%)		1 (8%)	1 (8%)	6 (50%)
Interview Volunteers	3 (7%)	3 (7%)	2 (4%)	2 (4%)	4 (9%)	5 (11%)	26 (58%)
Non-Volunteers	10 (11%)	9 (10%)	8 (9%)	4 (4%)	8 (9%)	9 (10%)	43 (47%)

Table 4.6 presents the number of years teachers stated they intended to remain in their current positions. Because the focus of this study was to identify factors contributing to teacher retention, interviewees were selected in higher proportions for the first two categories (less than 1 year and 1– 2 years) than had been found in the survey sample. While 34% of the interviewees intended to remain in their positions for two years or less, 24% and 25% of interview volunteers and non-volunteers, respectively, planned to remain for two years or less.

Table 4.6

Intended Years to Remain in Current Teaching Position for Interviewees, Interview Volunteers and Non-Volunteers

	Intended Years to Remain in Current Position			
	<1	1- 2	3-5	> 5
Interviewees	2 (17%)	2 (17%)	4 (33%)	4 (33%)
Interview Volunteers	6 (13%)	5 (11%)	9 (20%)	25 (56%)
Non-Volunteers	4 (4%)	19 (21%)	21 (23%)	47 (52%)

Teachers' commitment to teaching in an urban school was also considered during the selection of interviewees. As shown in Table 4.7, interview volunteers and non-volunteers showed the highest percentage of teachers expressing a strong commitment to teaching in an

urban setting. Both groups also showed the lowest percentage of teachers reporting a weak level of commitment. For the interviewees, 50% expressed strong commitment while the remainder reported neutral or weak levels of commitment to urban school teaching.

Table 4.7

Commitment of Interviewees, Interview Volunteers, and Non-Volunteers to Urban Teaching

	Commitment to Teaching in Urban School			
	Strong	Neutral	Weak	No Response
Interviewees	6 (50%)	4 (33%)	2 (17%)	X
Interview Volunteers	30 (67%)	9 (20%)	6 (13%)	X
Non-Volunteers	47 (50%)	16 (17%)	5 (5%)	27 (28%)

Reasons for entering teaching. Fifty-percent of interviewees gave altruistic reasons for entering the profession. A second-career teacher described her feelings in this way, "…every kid needs a good teacher. It doesn't matter if you are a poor kid, a rich kid, a suburban kid, an urban kid, a rural kid; and I wanted to be a good teacher." One-third of the interviewees described intrinsic rewards associated with teaching, and 25% of teachers provided reasons that revealed their desire to inspire young people. A second-career teacher, who began tutoring students before beginning her teaching career explained:

> I started doing a little bit of tutoring with the students, and I really discovered that I loved it. I loved seeing the expression on their face that they actually got the concept or got the idea and, you know, actually enjoyed learning.

Many interviewees (42%) also mentioned their love of subject matter in describing their reasons to teach. A first-career teacher, who was in her second year of teaching at her school,

commented, “I also realized that I wanted to be able to share my love of biology with other people.”

Of particular interest for the present study, are the reasons that career changers offered for leaving their previous career and for entering the teaching profession. Seven of the 12 interviewees were career-changers; they offered a variety of reasons or considerations that influenced their decisions to become teachers. Two second-career teachers explained that they had become unhappy or dissatisfied with their prior career, while a third teacher explained that the physical demands of his first career prompted him to seek an alternative. Two career-changers’ decisions to switch careers were influenced by anticipated declines in employment in their prior careers.

Reasons for entering the teaching profession also varied among career-changers. Three second-career teachers stated that they had had an early interest in teaching. Either financial concerns or reservations about their potential effectiveness led them to delay their pursuit of a teaching career. One teacher explained, for example, that when her financial needs decreased because her son had finished college, she was able to entertain the idea of teaching in spite of the salary reduction she would experience. Health benefits associated with a teaching job prompted one career changer to see the benefits of the career switch, as he got older. Two career changers explained that family members had encouraged them to pursue the shift into teaching. The varied reasons interviewees offered for their career change suggest that individual preferences and circumstances are significant aspects of career changers’ decision-making.

In accordance with this study’s focus on urban schools, interviewees were asked to share their thoughts about urban schools. The question was posed in an open-ended fashion so that

teachers could offer whatever insights or reflections they chose. The following section describes and summarizes their responses.

Reflections on urban school teaching. Half of the interviewees stated in their survey responses that their commitment to teaching in an urban setting was strong. Correspondingly, interviewees offered several positive reflections about urban schools. Interviewees' descriptions of intrinsic rewards associated with teaching in an urban school were of particular interest. Seven of the 12 interviewees described benefits derived from their urban teaching, which included enjoyment, fulfillment, and gratification. For instance, one first-career teacher explained, "Teaching in an urban high school is really fun for the simple reason that a lot of the kids benefit." A second-career teacher made a similar observation, "I really, really enjoy the urban district, because I feel like I am making a significant difference." Two teachers commented on the dramatic gains that students in urban schools could make as opposed to students in non-urban settings. This sentiment is evident in this first-career teacher's remarks:

> *Urban* has frequently come to be a co-word for 'poor,' I've discovered. For a more impoverished district, the kids have a whole lot more to gain, so when you do reach a kid or help out, it's a substantially greater reward than when a kid, you know, is going to get 15 different opportunities.

The intrinsic rewards these teachers derive from working with students in urban settings contribute to their commitment to their students. In particular, two second-career teachers effectively communicated the strength of their connection to their students in their reflections. One of these teachers, who is in her third year in her position, explained, "We do it because we love the students. They just bring so much to your life." The other career-changer has been in her position for more than seven years. She summarized her feelings in this way, "…one of the most

rewarding things that I've ever done in my life." The depth and strength of feeling in these teachers' remarks suggest a strong commitment to their students that may contribute, in turn, to a commitment to their schools.

Some interviewees discussed their students' characteristics. A few stated specifically that they felt students in urban school settings were no different from students anywhere. Other teachers alluded to higher student absenteeism in urban settings. Interestingly, while some interviewees noted that urban school students' families may not meet their children's needs, another teacher observed that the families of urban school students seem to care more about their children's education than do families in non-urban settings.

During their reflections on teaching in an urban school, interviewees raised relatively few problems. Three teachers mentioned limited availability of resources, while five teachers commented on characteristics of school climate, such as issues with student behavior. Four teachers mentioned job stress during their interviews, however no one offered it as a specific reason to remain in or leave a position. Therefore, while the challenging characteristics teachers described for urban schools may influence career decisions, no specific evidence of this was evident in their interviews. The challenges faced by urban schoolteachers were highlighted by the comments of one career-changer, "It takes a special breed of person to be an urban school teacher and be good at it."

This section has described this study's survey participants and interviewees. The next section explains the measures of reliability used for survey responses.

Survey Confidence Intervals and Internal Reliability

One hundred forty teachers accessed the online survey, and 138 of them consented to participate and began the survey. Of the 138 participants, 111 completed the survey, yielding an 80.4% completion rate. Taking into account those who did not complete the survey, between

131 and 124 participants answered the retention items in the survey (Part 2), yielding a margin of error between 7.72% and 7.98% with a confidence level of 95%. Because of the reduced participation rate toward the end of the survey, responses to the attrition items (Part 3) ranged from 124 to 117 participants, producing a margin of error between 7.98% and 8.27%, at the 95% confidence level.

Appendix A contains the online survey as it appeared in SurveyMonkey. Figures 4.6 and 4.7 have been included to identify the items that comprised each multi-item category of factors. Numbers in parentheses denote the item number assigned in the survey. Figure 4.6 depicts the four multi-item categories of retention factors addressed in Part 2 of the survey, and Figure 4.7 presents the categories of attrition factors found in Part 3 of the survey.

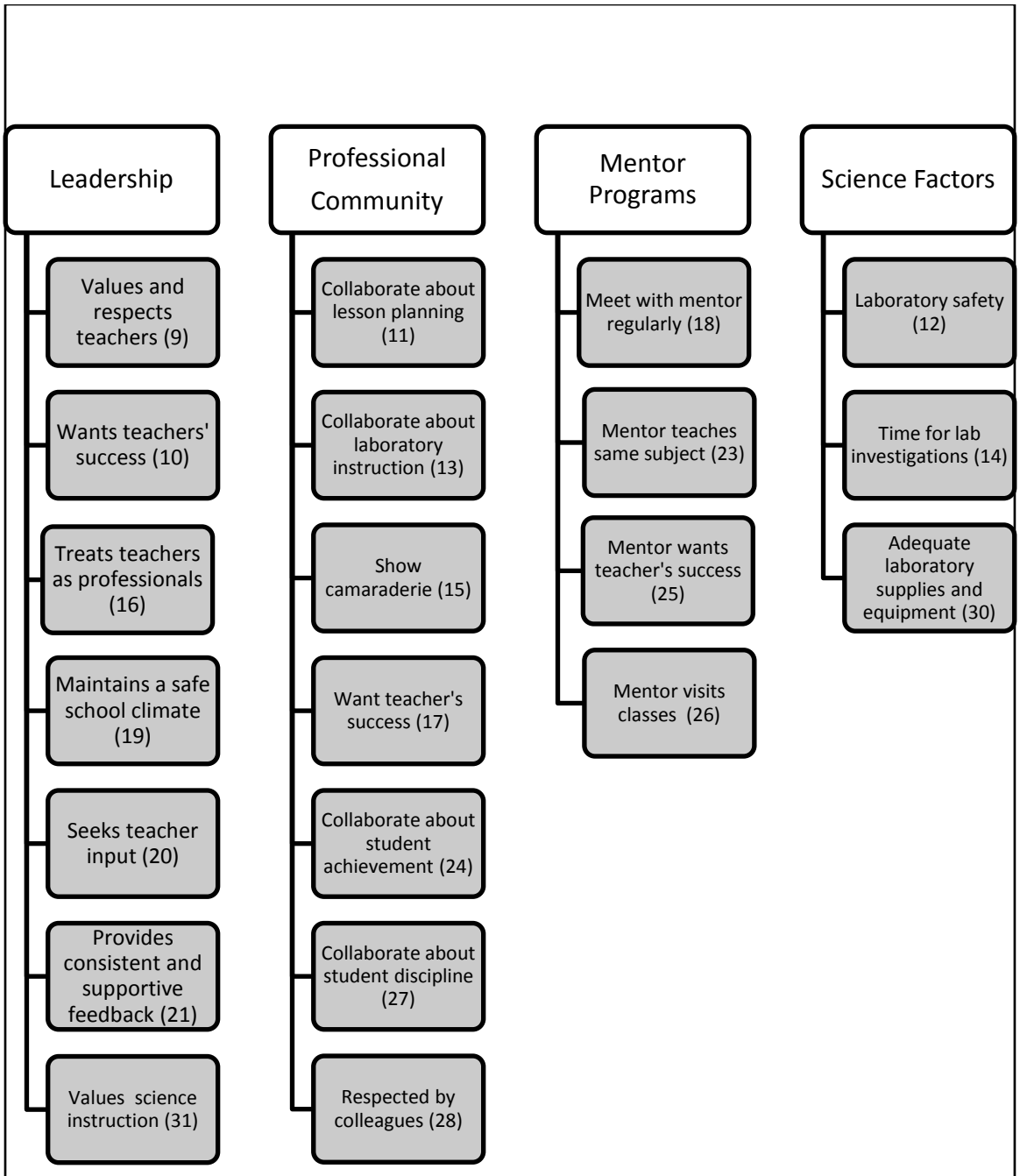

Figure 4.6. Multi-item categories of retention factors. Numbers in parentheses indicate survey item number.

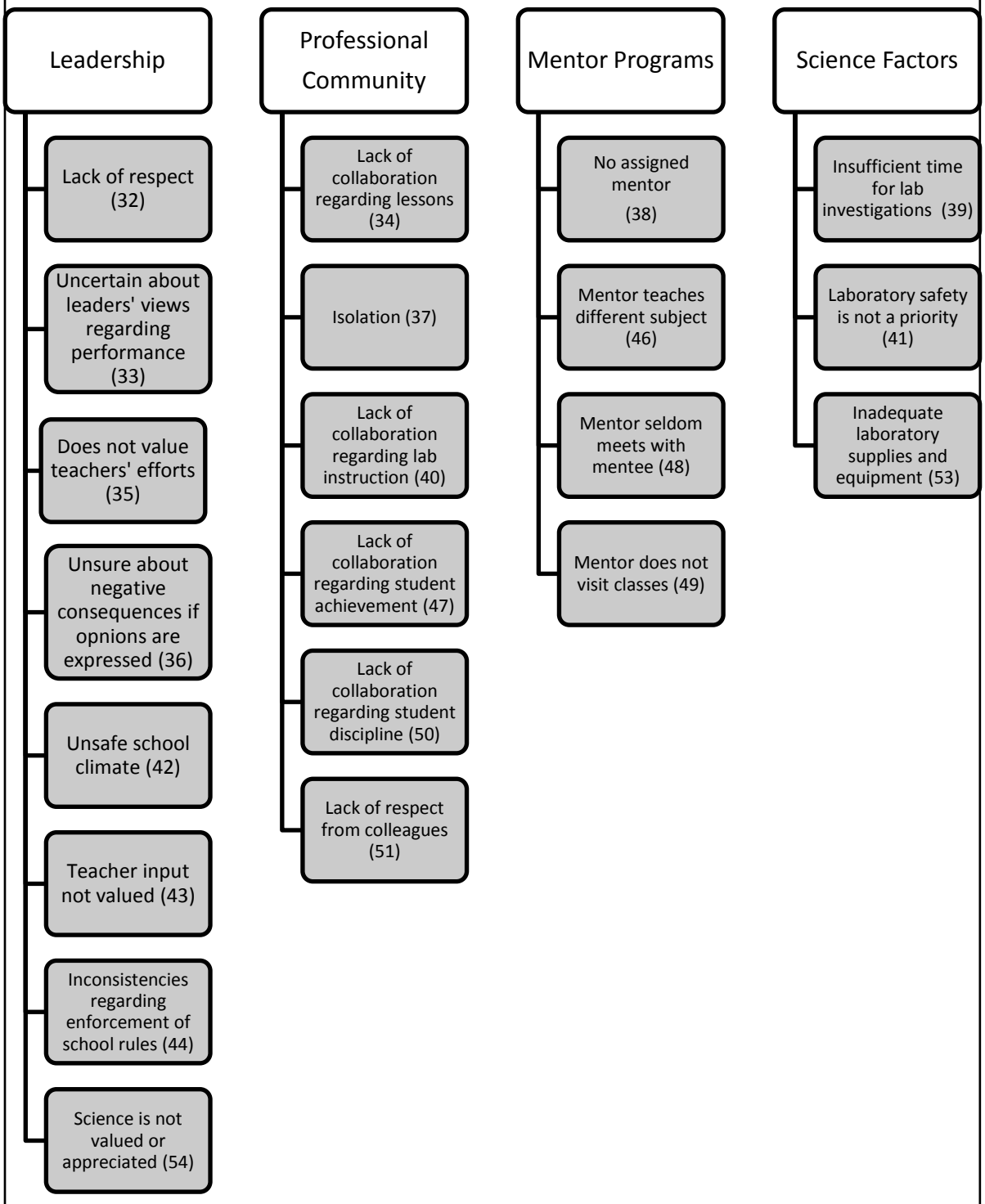

Figure 4.7. Multi-item categories of attrition factors. Numbers in parentheses indicate survey item number.

Internal reliability for the multi-item categories of *Leadership*, *Professional Community, Mentor Program*, and *Science Factors* was assessed using Cronbach's alpha. The results of this analysis for the four multi-item categories of retention factors and attrition factors are presented in Table 4.8. Internal reliability for each of the multi-item categories ranged from .757 to .931.

Table 4.8

Internal Reliability Measure for Categories of Retention and Attrition Factors

Category	Retention Factors			Attrition Factors		
	Number of Questions	**Cronbach's alpha**	**N***	**Number of Questions**	**Cronbach's alpha**	**N**
Leadership	7	.861	100	8	.875	117
Professional Community	7	.883	101	6	.875	117
Mentor Program	4	.931	48	4	.863	117
Science Factors	3	.869	107	3	.757	117

* N varies for these Retention Factor categories because *not applicable* (N/A) responses were excluded from this analysis.

Data Analysis Framework

The following research questions provide the organizing framework for this study's data analysis:

1. What are the conditions necessary to retain new science teachers in urban area high schools?
2. What are the similarities and differences in retention-promoting factors and attrition factors between first-career and second-career science teachers?
3. How do urban school leaders create the necessary conditions to foster retention of quality science teachers?

Five methods of data analysis are used to address Research Question 1, which seeks to identify the significant retention and attrition factors for science teachers in urban area high schools. Each method of analysis is described below:

1. As described in Chapter 3, a metric that would permit the comparison of individual survey items and multi-item categories was needed, since the mean rating score would not have been equivalent across items and categories. Therefore, the researcher calculated the percent of possible points for each item or category of items as a measure of its perceived significance by survey participants.
2. An analysis of variance (ANOVA) was performed to compare mean levels of significance among age groups of survey participants to determine whether science teachers' perceptions of retention and attrition factors would vary among teachers of different ages.
3. *t* tests were performed to compare the mean levels of significance among females and males to determine if there were gender differences in perceptions of retention and attrition factors.
4. Responses to two open-response survey items were coded and coding frequencies were used to identify important retention and attrition factors.
5. Interview transcripts were reviewed, and data were coded, organized, and interpreted relative to factors that contribute to teachers' commitment.

Four methods of data analysis are used to address Research Question 2, which seeks to compare first-career and second-career teachers' perceptions regarding retention and attrition factors. The methods of data analysis are summarized below:

1. To determine if there are differences in perceptions of first-career teachers and second-career teachers regarding the significance of retention and attrition factors, *t* Tests were performed to compare the mean responses of these two groups of survey participants.
2. Survey participants within their first three years in their positions were selected for a separate analysis. *t* Tests were used to compare the perceived significance of retention and attrition factors by first-career and second-career teachers within this subset of participants.
3. Second-career educators who had spent 10 or more years in a prior career were selected for a separate analysis. *t* Tests were used to compare the perceived significance of retention and attrition factors by first-career teachers and this subset of experienced second-career teachers.
4. The analysis of interview transcripts, used to address Research Question 1, was used to compare the perceptions of first-career and second-career interviewees.

Research Question #3 concerns the conditions that school leaders may create to promote the retention of science teachers in urban area high schools. To elicit teachers' suggestions for school leaders, interview question #4 asked, "As a first-career (or second-career) teacher, what conditions do you think urban high school leaders should create to promote the retention of their first career (or second-career) science teachers?" The qualitative data derived from this inquiry were coded, organized, and analyzed to address Research Question #3.

Analysis of Retention and Attrition Factors: Research Question 1

The intent of the first research question guiding this study is to identify the conditions necessary to retain new science teachers in urban schools. The following supporting questions direct the analyses to address the first research question:

1. What retention and attrition factors do science teachers deem most important?
2. Do teachers' perceptions of retention and attrition factors vary among different age groups?
3. Do females and males hold different perceptions of the importance of specific retention and attrition factors?

The next section examines the quantitative and qualitative data from this study with respect to the factors teachers perceive as being important in their decisions to leave or remain in a teaching position.

Survey results. The quantitative data obtained from the online survey are discussed here regarding factors that contribute to science teacher retention and attrition.

Relative significance of retention and attrition factors. Teachers' responses to the multi-item categories of retention and attrition factors in the online survey were analyzed for their perceived relative importance among all participants. As shown in Table 4.9, the survey revealed that *Leadership* ranked consistently highest among the multi-item categories of the retention and attrition factors addressed in this study. Perceived importance ratings for the category of *Leadership*, as measured by the percent total score (.76 as a retention factor and .73 as an attrition factor) document school leaders' significant role in promoting the retention of science teachers. *Mentor Programs*, by contrast, ranked least important of the multi-item categories of

retention (.56) and attrition factors (.40). As a retention factor, *Professional Community* (.73) ranked close to *Leadership* (.76), but as a factor affecting attrition, with a percent score of .60, it ranked approximately equal to *Science Factors* (.61).

Table 4.9
Percent Score for Multi-Item Categories of Retention and Attrition Factors

Retention Factor	Total Score	Points Possible	Percent Total Score
Leadership	4592	6027	0.76
Professional Community	4337	5950	0.73
Mentor Program	1162	2065	0.56
Science Factors	1770	2513	0.70
Attrition Factor			
Leadership	4826	6580	0.73
Professional Community	2980	4935	0.60
Mentor Program	1304	3283	0.40
Science Factors	1498	2471	0.61

Note. Total Score = the sum of teachers' ratings for all survey items in the category.
Points Possible = the sum of the number of respondents for all items in the category * 7 (maximum rating score).

Single survey items were used to assess teachers' perceived importance of *Induction Programs* and *Autonomy* as retention and attrition factors. While the researcher acknowledges that the reliability of single scale items is questionable (Gliem & Gliem, 2003), the data provided by these survey items are informative. As shown in Table 4.10, participants assigned relatively low importance to *Induction Programs* as a retention factor (.51) and as a factor contributing to attrition (.36). By contrast, *Autonomy* (the freedom to choose instructional approaches and methods of assessment) received a high importance rating, as shown in Table 4.10. Notwithstanding the limitations of single survey item interpretation, the importance assigned to *Autonomy* as a retention factor (.85) and as a factor that contributes to attrition (.81) is noteworthy.

Table 4.10
Percent Score for Induction Program and Autonomy

Retention Factor	Total Score	Points Possible	Percent Total Score
Induction Program	351	686	0.51
Autonomy	734	861	0.85
Attrition Factor			
Induction Program	296	819	0.36
Autonomy	666	819	0.81

Note. Total Score = the sum of teachers' ratings for the survey item.
Points Possible = the number of respondents for the survey item * 7 (maximum rating score).

In the retention factors section of the survey (Part 2), each question had a response option, *Not Applicable* (N/A), for participants to indicate that a specific factor had not been part of their experience in their current teaching position. Table 4.11 summarizes the *N/A* responses for the *Induction Program* survey item. Of the 124 respondents for the retention item of *Induction Program*, approximately 21% chose the *Not Applicable* response, indicating that an orientation or induction program was not part of their experience during their first year at their school. As shown in Table 4.11, eight participants used the comment portion of the survey item to confirm that they did not participate in an induction program. Other participants' comments reveal that some teachers participated in a program that they felt was of little value.

Table 4.11
Not Applicable Responses for Induction Programs

Item Number	Retention Factor	Percent *Not Applicable* Responses	Number of *No Induction Program* Comments
22	Having an induction or orientation program during first year in position	20.97%	8

The low ranking of *Mentor Programs* by the participants in this study warrants a closer review of the data. As shown in Table 4.12, for items 18, 23, 25, and 26, the *Not Applicable*

response rate was between 40% and 44%. While these responses might indicate no experience with the particular mentor program characteristic the item addressed, some *N/A* responses also indicate no experience with a mentor. As shown in Table 4.12, some participants' responses in the optional *Comments* section of this item confirm that they did not have an assigned mentor.

Table 4.12

Not Applicable Responses for Mentors as a Retention Factor

Item Number	Retention Factor	N/A Responses	N	Percent N/A Responses	Number of *No Mentor* Comments
18	Opportunities to meet with mentor	57	131	43.51%	7
23	Mentor who teaches same subject	50	124	40.32%	4
25	Feeling my mentor wants me to succeed	49	124	39.51%	4
26	Mentor visits classes	54	124	43.55%	2

Age-based perceptions of retention and attrition factors. Survey results were analyzed for the differences in perceptions of retention and attrition factors among different age groups of teachers. Teachers identified their age group through a survey item with the following age categories: Less than 30 years, 30-39 years, 40-49 years, and 50 or older. An analysis of variance (ANOVA) was used to test the equality of means (Gleason, 1981) among these age groups. Teachers' mean responses, by age group, for the multi-item categories and single survey items are presented in Tables H1 and H2, respectively. Because the ANOVA analysis assumes common variances among the groups being compared (Gleason, 1981), it was preceded by a test for homogeneity of variances (Levene's Test of Equality of Variances) for the retention and attrition factor multi-item categories and for the single survey items (*Induction Program* and *Autonomy*). Following the ANOVA, a post hoc analysis (Salkind, 2011), using Tukey's statistic, was conducted for those retention factors and attrition factors where a significant difference

among age groups had been found. The results of the homogeneity of variance analysis (Table H3), ANOVA (Table H4), and the post hoc analysis are provided in Appendix H.

As shown in Table H.3 in Appendix H, homogeneity of variances was confirmed for *Professional Community* and *Induction Program* as retention factors, and *Leadership*, *Professional Community*, *Mentor Program*, and *Science Factors* as attrition factors. Therefore, the ANOVA was calculated for these retention and attrition factors. This analysis revealed that two multi-item categories of attrition factors showed significant differences among the four age groups: *Professional Community* ($F(3,109) = 2.59$, $p = .057$) and *Science Factors* ($F(3,109) = 3.76$, $p = .013$). As identified in Table H5, the post hoc analysis (Tukey's statistic) showed that the difference in perception of *Professional Community* as an attrition factor occurred between the 30-39 year-olds and the 40-49 year olds ($p = .042$). The differences in perception of *Science Factors* as influencing attrition decisions occurred for two sets of participants: between those less than 30 and the 40 – 49 year olds ($p = .025$) and between the 30-39 year olds and the 40 – 49 year olds ($p= .018$). The 40-49 year olds ranked both *Professional Community* and *Science Factors* as more significant attrition factors than did the younger age groups.

Much of the age group data regarding retention and attrition factors showed considerable variation within age groups. The six categories of retention and attrition factors identified above showed the homogeneity of variance needed for the ANOVA. The ANOVA results suggest that there is limited variation in perceptions of retention and attrition factors among science teachers of different age groups. Nevertheless, this analysis has shown that the importance of a strong professional community and factors related to science instruction may vary among some age groups.

Gender-based perceptions of retention and attrition factors. The mean responses for females and males for the retention and attrition factors addressed in this study are shown in Tables 4.13 and 4.14. Table 4.13 presents the mean responses for the multi-item categories of factors, and Table 4.14 presents the mean responses for the single items that addressed *Induction Program* and *Autonomy*.

Table 4.13

Mean Responses of Females and Males for Categories of Retention and Attrition Factors

	Females		Males		Range of Possible Scores
Retention Factor	N	M (SD)	N	M (SD)	
Leadership	68	35.63 (9.87)	45	35.82 (10.46)	7-49
Professional Community	68	34.79 (9.94)	45	33.09 (10.09)	7-49
Mentor Program	68	9.26 (8.91)	45	9.51 (9.46)	4-28
Science Factors	68	13.66 (5.66)	45	13.53 (5.46)	3-21
Attrition Factor					
Leadership	68	41.44 (8.83)	45	40.76 (11.32)	8-56
Professional Community	68	25.98 (8.30)	45	24.40 (8.85)	6-42
Mentor Program	68	10.68 (5.97)	45	11.98 (7.16)	4-28
Science Factors	68	12.59 (4.49)	45	12.91 (4.45)	3-21

Note. M is the mean of perceived significance scores for each category of retention and attrition factor.

Table 4.14

Mean Responses of Females and Males for Single Item Retention and Attrition

	Females		Males	
Retention Factor	N	M (SD)	N	M (SD)
Induction Program	53	3.66 (1.96)	35	3.54 (2.43)
Autonomy	67	6.03 (1.48)	45	5.89 (1.28)
Attrition Factors				
No Induction Program	68	2.34(1.59)	45	2.96 (2.20)
Lack of Autonomy	68	5.71 (1.55)	45	5.69 (1.40)

Note. M is the mean of perceived significance scores for each category of retention and attrition factor that range from 1 to 7.

The mean responses of females and males were compared using a *t* test. Because the *t* test assumes equal variances in the compared groups, Levene's Test of Equality of Means was used to confirm equality of means between males and females.

As shown in Table 4.15, the *t* test comparison of the means of retention and attrition factors revealed no significant difference (p = .05) between the perceptions of females and males as to importance of the eight multi-item categories of retention and attrition factors.

Table 4.15

t Test Results for Multi-item Categories: Gender Comparisons

		LT for EV		t-Test for Equality of Means					
Retention Factors		F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Leadership	Equal variances assumed	.08	.78	-.098	111	.922	-.19	1.94	[-4.04, 3.66]
Professional Community	Equal variances assumed	.03	.85	.888	111	.377	1.70	1.92	[-2.10, 5.51]
Mentor Program	Equal variances assumed	.01	.94	-.141	111	.888	-.25	1.75	[-3.72, 3.22]
Science Factors	Equal variances assumed	.21	.65	.120	111	.905	.13	1.07	[-2.00, 2.25]
Attrition Factors									
Leadership	Equal variances assumed	1.86	.18	.361	111	.719	.69	1.90	[-3.08, 4.45]
Professional Community	Equal variances assumed	.11	.74	.968	111	.335	1.58	1.64	[-1.66,4.83]
Mentor Program	Equal variances assumed	.72	.40	-1.046	111	.298	-1.30	1.24	[-3.77, 1.16]
Science Factors	Equal variances assumed	.28	.60	-.376	111	.708	-.32	.86	[-2.03, 1.38]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error and CI is Confidence Interval.

Table 4.16 shows the *t* test results comparing females and males' perceived importance of *Induction Program* and *Autonomy* as retention or attrition factors. Where equality of variance was not confirmed for the two groups (*Induction Program* and *No Induction Program)*, results are indicated in Table 4.16 by "equal variances not assumed." The analysis summarized in Table 4.16 reveals that there was no significant difference (p = .05) between females and males with respect to the importance of *Induction Program* and *Autonomy*.

Table 4.16

t Test Results for Single Item Categories: Gender Comparisons

		LT for EV		t-Test for Equality of Means					
Retention Factors		F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Induction Program	Equal variances assumed	6.39	.01	.250	86	.803	.12	.47	[-.82 – 1.05]
	Equal variances not assumed			.239	62.03	.812	.12	.49	[-.86 - 1.10]
Autonomy	Equal variances assumed	1.02	.31	.521	110	.603	.14	.27	[-.40 - .68]
Attrition Factors									
No Induction Program	Equal variances assumed	10.69	.001	-1.73	111	.086	-.62	.36	[-1.32 - .09]
	Equal variances not assumed			-1.63	73.99	.108	-.62	.38	[-1.38 - .14]
Lack of Autonomy	Equal variances assumed	.04	.85	.06	111	.953	.02	.29	[-.55 - .58]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error and CI is Confidence Interval.

Survey open-response item results. The online survey included two open-response items (items 55 and 56) that asked teachers to comment on any retention or attrition factors that were important to them, but had not been addressed in the survey. The researcher reviewed these

responses and established representative coding categories for teachers' comments in each open-response item. The summary of these results follows.

Retention factors. Fifty-nine teachers responded to Item 55 of the survey**,** which asked them to describe factors or conditions that contributed to their decision to remain in their current teaching position. Although the question was intended to provide teachers with an opportunity to identify factors not addressed by survey items, some responses to Item 55 overlapped items in Part 2 of the survey. All responses were coded with representative labels; this process produced 30 categories of responses. The relative frequency of response categories was determined using the number of item respondents for each category. For the purpose of this analysis, designed to identify the most significant factors affecting retention, categories were selected for review if 10% or more of respondents cited that factor. Figure 4.8 displays the seven categories of factors respondents identified most often.

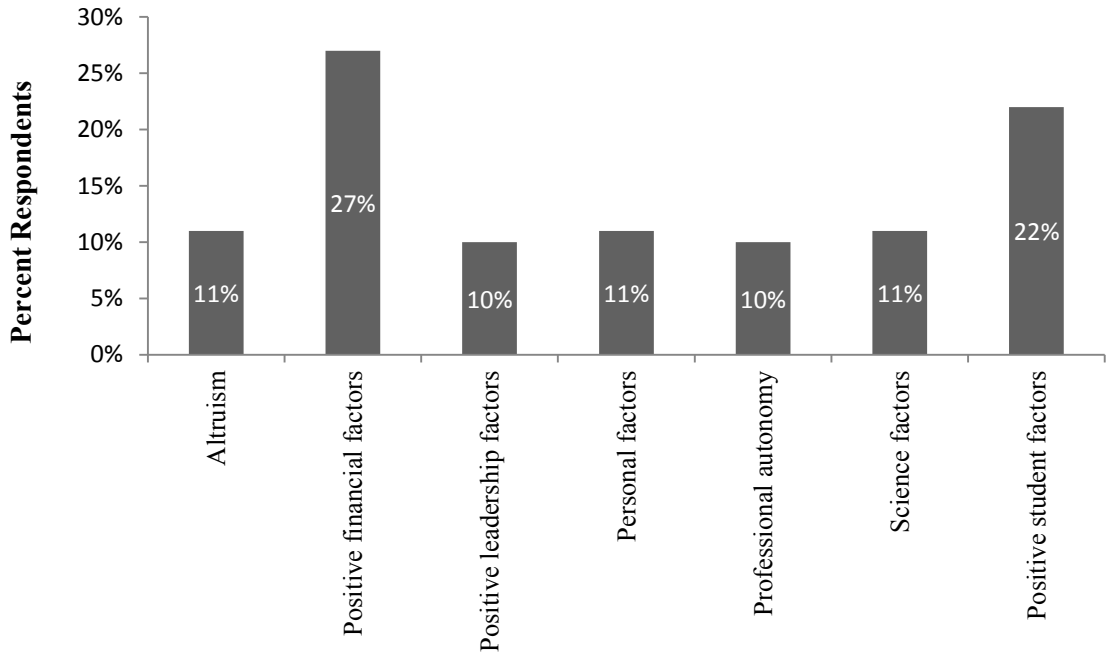

Figure 4.8. Frequency of respondents' identification of retention factor categories in open-response survey items.

As Figure 4.8 illustrates, 27% of the respondents explained that *Positive Financial Factors,* such as salary, a loan-forgiveness program, and retirement benefits, contributed to their decision to remain in their teaching position. The second highest category of retention factors, *Positive Student Factors*, included comments from 22% of respondents. The researcher placed teachers' comments such as, "fantastic" students, "hardworking" students, "diversity of students" in this category. Teachers' remarks describing their love for their students, students' appreciation of their work, or simply "the students" as reasons for remaining in a position were also placed in this category. Eleven percent of item respondents described altruistic motivations, labeled as *Altruism*. For instance, some teachers stated they wanted to work where they felt most needed, where they could make the greatest difference for students, or where they could help at-risk students.

Four other categories, shown in Figure 4.8, include retention factors mentioned by 10 to 11 percent of respondents. In the category labeled *Science Factors*, 11% of item respondents described the availability of resources, teachers' ability to teach preferred subjects, or their ability to conduct field trips. *Professional Autonomy*, expressed as the ability to determine instructional approaches, write grants, arrange classroom features, or not feel micro-managed, was mentioned by 10 % of the item respondents. The same percentage of respondents described *Positive Leadership Factors* as a reason contributing to their decision to remain in their position. These teachers described supportive and helpful leaders who fostered their retention. Finally, 11% of the item respondents cited *Personal Factors* as retention factors. These teachers identified family concerns, familiarity with the school setting, and, most often, proximity to home as reasons contributing to their decision to remain at their schools.

Attrition factors. Fifty-seven teachers responded to Item 56 of the survey**,** identifying factors or conditions, not addressed in the survey, which would contribute significantly to their decision to leave a teaching position. As for Item 55 on retention factors, some items earlier in the survey had addressed topics teachers mentioned in Item 56 as attrition factors. All responses were coded with representative labels; this process produced 35 categories of responses. The relative frequency of response categories was determined using the number of item respondents for each category. For the purpose of this analysis, categories were selected for review if 10% or more of respondents described that factor. Figure 4.9 displays the four categories of factors respondents identified most often.

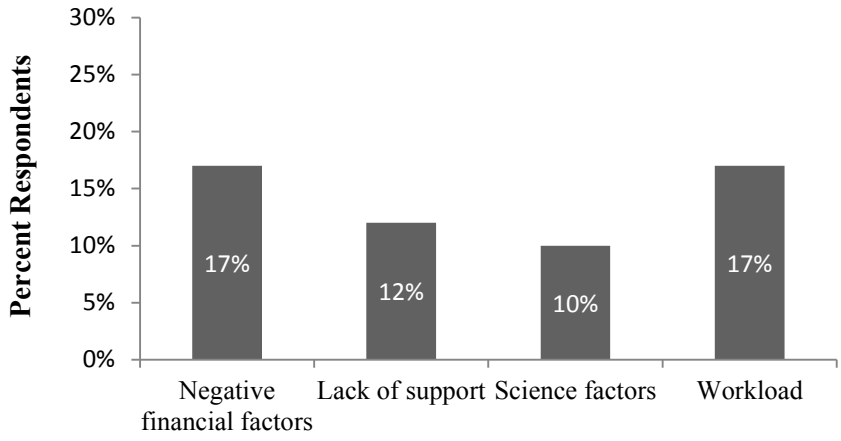

Figure 4.9. Frequency of respondents' identification of attrition factor categories in open-response survey items.

Figure 4.9 illustrates that 17% of respondents for Item 56 described *Negative Financial Factors* and *Workload* as significant; these two categories emerged as the highest attrition factor categories. *Negative Financial Factors* included salary and contract problems. *Workload* was described as excessive by respondents, and for some, stress was an accompanying factor. Teachers described difficulties managing extracurricular activities, administrative tasks, and

communicating with students' families in addition to having insufficient time in the schedule for lesson preparation and managing student work. *Lack of Support* was the next most common category of responses, with 12% of item respondents discussing this factor. Most of these teachers described a lack of administrative support regarding student discipline issues. Finally, 10% of teachers indicated that factors related to teaching science, labeled *Science Factors* by the researcher, would affect their decisions to leave a position. Their reflections centered on curriculum issues, such as an inability to teach desired subjects, and inadequate supplies or equipment.

Interview results. During interviews, teachers were asked to describe conditions that fostered their desire to remain in a position. To elicit this information, the second interview question (Appendix B) incorporated the concept of *glues* developed by Richard Finnegan in *Rethinking Retention in Good Times and Bad* (2010). Finnegan uses *glues* to describe the special characteristics of a place of employment that make employees want to stay. Therefore, this interview question asked teachers to describe school conditions that helped to build their commitment. By contrast, the third interview question asked interviewees to describe conditions they felt would contribute to their decision to leave a position. This method of inquiry yielded a variety of responses. Coding and subsequent analysis of teachers' responses to these questions produced several categories and subcategories of their perceptions, which are identified in Figure 4.10.

The process of qualitative data analysis is a complex interplay of categorizing, organizing, and interpreting the pieces of information that have been gathered (Glesne, 1999). Glesne (1999) explains, "Working with the data, you describe, create explanations, pose hypotheses, develop theories, and link your story to other stories. To do so, you must categorize,

synthesize, search for patterns, and interpret the data you have collected" (p.130). Figure 4.10 depicts the researcher's conception of how teachers' perceptions of school conditions contribute to their commitment. Because this study's objective is to identify conditions that school leaders might create to improve the retention of their science teachers, the researcher evaluated teachers' descriptions of school factors and inferred the reasons for their importance, using a framework informed by the literature. Maslow's hierarchy of needs (Finnegan, 2010; Maslow, 1943) and research which has revealed a correlation between teacher retention and teachers' success (Alliance for Excellent Education, 2008; Birkeland & Johnson, 2003; McKinney et al., 2007), have provided a foundation for the analysis.

Data analysis began with the researcher assigning code labels to segments of interview transcripts. As the process of coding continued, preliminary code categories were built and new categories were added as the need emerged. Glesne (1999) describes the iterative process of coding and category development that was used:

> Coding is a progressive process of sorting and defining and defining and sorting those scraps of collected data…that are applicable to your research purpose. By putting like-minded pieces together into data clumps, you create an organizational framework. It is progressive in that you first develop, out of the data, major code clumps by which to sort the data. Then you code the contents of each major code clump, thereby breaking down the major code into numerous subcodes. (Glesne, 1999, p.135)

The preliminary codebook developed for this study contained nine categories that identified factors or conditions affecting teachers' commitment to a school setting. Ultimately, repeated analysis and evaluation of the codes distilled the nine categories into the five shown in Figure 4.10: *Safety, Identity, Connections, Respect, and Efficacy.* The diagram in Figure 4.10

resulted from a process of *data transformation* (Glesne, 1999). "The art of data transformation is in combining the more mundane organizational tasks with insight and thoughtful interpretations" (Glesne, 1999, p.138). Specific classification criteria were used to place each cluster of coded interview segments in one of the five major categories. To help the reader understand and assess the validity of the researcher's classification scheme, the criteria applied to each code category and subcategory are provided when each topic is addressed in the analysis that follows. Because the researcher has developed this classification scheme, her views as a former teacher and science supervisor may have influenced her interpretations, but her intention has been to bracket out those influences and preserve the authenticity of the interviewees' perspectives.

Figure 4.10 depicts the researcher's interpretation of the way teachers build commitment to their school settings. The relative sizes of the circles in the diagram reflect the coding frequencies indicated for each category. Thus, the circle size also represents the relative significance of each category of factor. Category code frequencies, shown in Figure 4.10, and subcategory code frequencies, provided in Tables 4.16 – 4.20, were determined by adding the number of coded segments from both the positive (retention) and the negative (attrition) viewpoints in each group and dividing by the total number of codes for the group. A small number of coded interview segments (18) were not included in this analysis because they described conditions beyond the control of school leaders. Excluded segments addressed thoughts of career advancement within education, personal or family concerns, and licensure requirements.

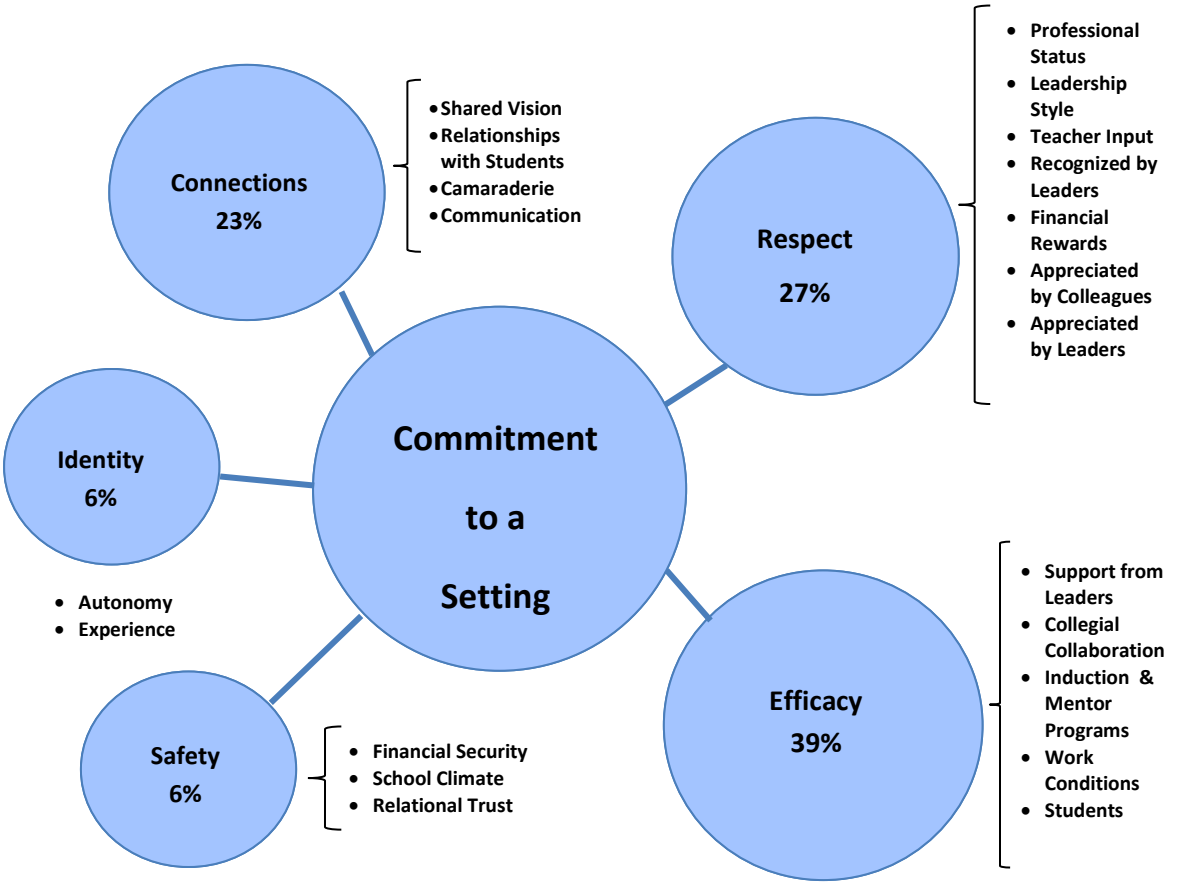

Figure 4.10. Factors contributing to teacher commitment. Sum of percentages does not equal 100% due to rounding.

Safety. The basic human need to feel safe (Maslow, 1943) was evident in five of the 12 interviewees' remarks. Coded interview segments were placed in the *Safety* category if they reflected the importance of physical, emotional, or psychological safety among interviewees. As shown in Table 4.17, the researcher established three subcategories for *Safety*: *Financial Security, School Climate, and Relational Trust*.

Table 4.17

Classification Criteria, Code Frequencies, and Number of Interviewees in the Coding Subcategories for Safety

Subcategory	Classification Criteria	No. of Codes/ Category Total	Code Frequency	No. of Interviewees
Financial Security	Monetary factor connected to personal or family security	9/16	56%	3
School Climate	School atmosphere relative to student discipline and civility	4/16	25%	4
Relational Trust	Ability to voice opinions without fear of repercussion	3/16	19%	1

Interview data revealed that financial concerns related to personal or family financial security affected the employment decisions of three female interviewees who are first-career teachers. Financial matters that related to feeling safe ranged from financial security issues associated with inadequate pay, on the negative end, and pension benefits and loan forgiveness programs on the positive end. For example, a first-career teacher in her fifth year in her school felt conflicted in her decision to leave her position, "It's a really good place to work, and I just don't want to leave, but again, it's finances that are going to force me to do that." Another first-career teacher provided an example of how financial benefits can foster retention, albeit for a limited time, "I am currently taking advantage of the teacher loan forgiveness program. So that actually requires that you stay in a position in Massachusetts for a total of 5 years, so because of that I am definitely planning on staying here for at least another 3." The third first-career teacher

illustrated how retirement benefits affected her intent to remain in her position, "It's 10 years to get vested for a pension. So I'm already at 8 ½ (years), so I should at least do the extra two (years)." These interviewees' explanations of financial concerns suggest that these factors affect teacher retention through their influence on teachers' feelings of financial security. Later, the connection between financial factors and respect, another category of factors influencing teachers' commitment, will be discussed.

Four interviewees addressed school climate characteristics, which the researcher assigned to a second subcategory of safety-related factors. As shown in Table 4.17, coded interview segments that referenced an orderly, courteous, or respectful school atmosphere were placed in this subcategory of *Safety*. For instance, a second-career teacher described her school's organized and cohesive approach to school-wide discipline,"…they (school leaders) have a united front on discipline, and I think that makes an extreme amount of difference." Two first-career teachers discussed the kind and friendly environment in their schools; one reflected, "…it was a very friendly work environment." Ongoing, daily gestures of civility reflected a culture of kindness. One of these teachers also described the understanding and kindness shown to her during an especially difficult time in her life. She explained, "…that's the type of school that I want to work at. Where they care about the teachers, they care about people who work with them. The kids all made me cards and they sent things and … It's a really good place to work." The comments of a career-changer echoed the importance of a positive school climate, "…creating and maintaining a school atmosphere. I think that is something that administrators are highly responsible for, and it's really important, I think, to have a school atmosphere that is positive and have that maintained throughout the year."

The researcher developed a third subcategory of safety-related factors to include a teacher's comments regarding relational trust. A workplace marked by relational trust would show open and honest communication without fear of retribution. Lencioni (2002) explains "the absence of trust" results from team members' "unwillingness to be vulnerable within the group" (p. 188). Therefore, coded interview segments that demonstrated a teacher's concern about possible repercussions resulting from expressing his or her opinion were placed in the *Relational Trust* subcategory. A lack of trust was evident, for example, in the words of a first-career teacher who said, "Right now I work in a district where no teacher feels like they can so much as mention a disagreement with the principal." The relationship between relational trust in a work setting and the psychological and emotional safety of employees is evident in the reflections of this interviewee.

Identity. Some responses to interview questions revealed teachers' need to preserve and support their identity. As shown in Table 4.18, the researcher organized teachers' comments related to identity into two subcategories: *Autonomy* and *Experience*. The researcher acknowledges that these subcategories might have been placed within the category labeled *Respect.* However, because this study compares first-career and second-career science teachers, *Autonomy* and *Experience* were related to *Identity,* a construct examined for differences between the two career status groups. Using the criteria listed in Table 4.18, the researcher classified the statements of six interviewees, two first-career teachers and four career-changers, in the *Identity* category.

Table 4.18

Classification Criteria, Code Frequencies, and Number of Interviewees in the Coding Subcategories for Identity

Subcategory	Classification Criteria	No. of Codes/ Category Total	Code Frequency	No. of Interviewees
Autonomy	Ability to exercise professional judgment regarding pedagogy or curriculum	10/15	67%	4
Experience	Comparison of first career (non-teaching) experience with teaching career	5/15	33%	3

Of the four interviewees whose comments addressed *Autonomy*, two career-changers and one first-career teacher described a lack of professional autonomy. A second-career educator, with over 20 years of experience in her first career and approximately 10 years of teaching experience, was one of the three teachers who described a lack of autonomy. Referencing a previous teaching position, she explained, "There was very little that teachers could do without being controlled on how to do it." She explained that, although she had served in that position for some time, changes in school conditions that reduced her autonomy contributed to her decision to leave that position. Conversely, a first-career teacher described his freedom in planning laboratory activities and in working with athletic teams.

Given this study's survey results, in which *Autonomy* received a high rating of importance (Table 4.10), one might have expected more than four interviewees to have discussed autonomy as a factor affecting their level of commitment. Nevertheless, both survey and interview results identify *Autonomy* as an important consideration for science teacher retention. Furthermore, while not definitive, the results suggest that *Autonomy* may be of particular importance to career-changers.

Three second-career teachers referred to their previous careers during their interviews. The researcher categorized such coded segments as *Experience* because they reflected the importance of career-changers' prior experiences as aspects of their professional identity. For example, a second-career interviewee compared the leadership practices he had experienced in business with the leadership approach he had seen in education. He observed that collaborative leadership, which he preferred over authoritarian leadership, is more common in business than in education. This career changer's observations will be mentioned later in this analysis regarding teachers' perceptions of an authoritarian leadership style. Here, however, they illustrate the influence of previous professional experiences on the views of a second-career teacher. Another career changer commented that she did not actually leave her first career, "I've never given up my first career. My first career was athletic training. I've never given that up. I am still working in athletic training." This teacher's comments suggest positive feelings associated with maintaining her professional identity as an athletic trainer in addition to her new role of high school science teacher. The significance of these findings for career-changers will be addressed later in reference to the second research question of this study.

Connections. Interviewees provided many descriptions of factors that reflected teachers' need to be part of a larger community. The researcher placed such comments, which comprised 23% of coded interview segments, in the category, *Connections*. As shown in Figure 4.10 and Table 4.19, the researcher organized the *Connections'* codings into four subcategories: *Shared Vision, Relationships with Students, Camaraderie,* and *Communication*.

Table 4.19

Classification Criteria, Code Frequencies, and Number of Interviewees in the Coding Subcategories for Connections

Subcategory	Content Criteria	No. of Codes/ Category total	Code Frequency	No. of Interviewees
Shared Vision	• Shared mindset with leaders and colleagues regarding philosophy, mission, student achievement, community outreach, STEM education • Shared sense of teacher motivation, commitment, and culture of high expectations	26/62	42%	8
Relationships with Students	Intrinsic rewards, such as positive feelings associated with working with students	13/62	21%	7
Camaraderie	• Enjoy working with colleagues; cohesive relationships • Absence described as cliquish behavior; favoritism	14/62	23%	7
Communication	• Explicit or implied ineffective communication by leaders or colleagues • Effective communication by leaders with staff and/or all stakeholders	9/62	14%	3

By applying one of two criteria, the researcher determined that 42% of the coded text in *Connections* addressed *Shared Vision*:

- Teachers' comments referenced a shared mindset among teachers and school leaders regarding their philosophy of teaching, mission as educators, expectations for student achievement, community outreach, or Science, Technology, Engineering and Mathematics (STEM) education.

- Teachers' comments reflected a shared sense of motivation, commitment, and a culture of high expectations for teachers.

The role of *Shared Vision* in fostering a sense of belonging to a community was evident in the comments of eight of the 12 interviewees. These teachers described the importance of shared values, mission, or goals among teachers and school leaders. Examples of shared vision included the importance of STEM education, high expectations for all students, and teachers' commitment to do their best for their students. A teacher in her second year at her school, described the importance of STEM education to her, "So, lack of support for the STEM topics is something that administrators might do that would make my commitment less." Another interviewee, a first-career biology teacher, described problems within her department resulting from differences in teaching philosophy between her and her colleagues, "I would say that my commitment to this particular school is weak. I believe that because of a difference in philosophy about the way biology should be taught." The reflections of these science teachers suggest that differing views about science curriculum and pedagogy may detract from teachers' commitment to their schools.

Some interviewees discussed their views about expectations for students and teachers. For example, a career-changer, with many years' experience in his school, explained that a lack of shared vision regarding expectations for students could contribute to his decision to leave a teaching position,

> …I haven't taught in any school yet where there is an abject culture of low expectation, but I can certainly see that if I was in an environment where school leaders were not making an effort to have a positive school culture, have high expectations, academics and

> behaviorally, that would be a nightmare. And that would certainly be a reason to move on.

Another career-changer addressed the commitment and motivation of teachers and, "the mindset that we are all in this for the students." She explained the benefits of a community of teachers embracing this mindset,

> Every teacher in the building needs to be part of the machinery, because that's just what makes educational opportunities so much richer for the kids. That's what will get them motivated. If they see all of their teachers motivated, that will motivate them.

These examples suggest that some teachers value highly a shared mindset with their colleagues and leaders regarding a school's goals, direction, and values. Furthermore, these examples indicate that such conditions may be significant in fostering teachers' commitment.

The researcher established a second subcategory of factors, *Relationships with Students,* to include coded interview segments that referred to intrinsic rewards associated with teaching students. These comments from teachers were interpreted as a component of *Connections* to their school community. Seven interviewees identified positive relationships with their students as a factor that contributes to their commitment. The following are examples of six of the teachers' comments regarding their feelings toward their students:

- "If we do this, everyone says we do it for the kids. We do it because we love the students. They just bring so much to your life."
- "I love teaching here, I love the people I work with; I really enjoy the kids."
- "My top interest is urban settings with high-need, high-risk students because I seem to do well with them. I enjoy it, anyway. It's more interesting for me."
- "I do like it where I am. It's not perfect, but I like the kids."

- "I love my students."
- "It's the intrinsic reward that keeps me here. … I would characterize it as my relationships with my students."

The seventh interviewee, whose comments were assigned to *Relationships with Students*, is a second-career educator, with more than seven years in his current position. He explained that leadership conditions have declined in recent years in his school. In spite of these changes, however, his commitment to the school remains strong because of his commitment to his students. During his interview, he asserted, "My *glues* in this school are the students. Many of these kids don't have anything." Later he concluded, "If it wasn't for the students, I probably would be looking to go somewhere else."

As illustrated in Figure 4.10, *Camaraderie* is the third subcategory assigned to *Connections.* The researcher placed coded interview segments in this subcategory if the interviewee referred explicitly to camaraderie or if they revealed teachers' positive or negative feelings about relationships among colleagues.

Through this data analysis, *Camaraderie* emerged as an important aspect of *Connections,* with the researcher assigning approximately 23% of its coded segments to this subcategory. Half of the interviewees described school conditions that reflected a sense of camaraderie among teachers. For instance, a teacher in her second year at her school stated, "We spend a lot of time outside of school together just because we enjoy each other's company." Another teacher mentioned, "I really get along with the people I work with," while a third teacher summarized her feelings in this way, "So there is a real, real, strong, positive, cohesive relationship within the science department and that, to me, is a very, very important *glue*." Conversely, one teacher was unhappy in her department. She described her perceptions of favoritism, "… people who report

this are hand-picked…" and, "It's very cliquey, and also there isn't a respect for different viewpoints." In total, seven interviewees addressed *Camaraderie*, and most of them reported positive experiences regarding the teachers with whom they work.

The last group of coded segments, approximately 14% of the codings assigned to the *Connections* category, encompassed those that addressed *Communication.* As summarized in Table 4.19, interview segments that conveyed teachers' views about communication by school leaders, with colleagues, or with stakeholders were assigned to *Communication.*

Three teachers mentioned factors coded as *Communication*. A second-career teacher, who is in her first year in her position, spoke very positively about communication practices that extend to all stakeholders in her school. She summarized her thoughts in this way, “We have a lot of communication attempts and communication success, you know, with talking to families, and to each other, about each individual child, and what their needs are at any given moment.” By contrast, two interviewees described communication problems in their schools, with one teacher identifying poor communication as “a major issue” in his school, and the other teacher citing "a lack of communication within the department." The role of effective communication in supporting professional community was evident in the comments of these three science teachers.

Respect. As shown in Figure 4.10, the researcher identified the need for respect as a unifying theme for 27% of the coded interview segments. Ten of the 12 interviewees addressed respect-related topics during their interviews, suggesting the importance of *Respect* as a retention factor. The researcher established seven subcategories of coded respect-related transcript segments, depicted in Figure 4.10. Table 4.20 summarizes the classification criteria, code frequencies, and the number of interviewees for each of the seven subcategories: *Professional*

Status, Teacher Input for Decision-Making, Leadership Style, Appreciated by Leaders, Recognized by Leaders, Financial Rewards, and Appreciated by Colleagues.

The theme most often reflected in teachers' comments regarding respect was the need to be treated as a professional, labeled *Professional Status* for this analysis. The researcher classified interview segments in this subcategory of *Respect* if they included a direct reference to "treated as a professional" or if they met one of these criteria:

- comments reflected teachers' desire to be respected for their professional skills and knowledge
- comments described teachers' expectation that leaders would believe in their capability, responsibility, motivation, and/or trustworthiness
- comments suggested a lack of courtesy from school leaders.

Six interviewees, five career-changers and one first-career teacher, described conditions that met at least one of these criteria.

Table 4.20

Classification Criteria, Code Frequencies, and Number of Interviewees in the Coding Subcategories for Respect

Subcategory	Content Criteria	No. of Codes/ Category Total	Code Frequency	No. of Interviewees
Professional Status	• Teachers' professional skills and knowledge are respected • Leaders believe that teachers are capable, responsible, motivated, and trustworthy • Courtesy	19/74	26%	6
Leadership Style	Authoritarian approach (includes offensive manner)	13/74	18%	6
Teacher Input for Decision-Making	Teachers' ideas, concerns, suggestions, and feedback are solicited and inform school leaders' work	14/74	19%	5
Recognized by Leaders	• Positive feedback • Acknowledgement of job well done • Reward	7/74	10%	5
Appreciated by Leaders	• Understanding and valuing teachers' time and effort • Teachers' professional skills, knowledge, and experience valued • Encouragement	13/74	18%	6
Appreciated by Colleagues	Views, knowledge, and skills are valued by colleagues	3/74	4%	3
Financial Rewards	Monetary factor with explicit or implicit reference to it as a reflection of worth	5/74	7%	4

Note. Sum of percentages does not equal 100% due to rounding.

A second-career teacher in her first year at her school was among the interviewees whose comments addressed teachers not being treated as professionals. This teacher felt some school

leaders micromanage teachers. Reflecting upon the negative consequences of micromanaging staff, she asserted, “When you micromanage, you undermine and disrespect the people who are working for you.” Other interviewees explained that teachers want to be respected for their pedagogical knowledge. For instance, a career-changer explained, "If we have an entirely different idea of how our lessons should go, there should be at least some credibility placed on the teacher." Another career-changer expressed concerns regarding professional development,

> There is a certain atmosphere between administration and teachers that … looks at teachers like they are line workers at a factory, and it has a sort of atmosphere of "us versus them." You know, teachers are not treated as professionals who have something to offer regarding their own professional development. So, when that attitude and atmosphere is prevalent, then it's a sign that it's time to move on.

Other comments from interviewees indicated that some teachers felt their leaders did not believe in them as professionals. For example, a career-changer in his third year at his school described his perceptions regarding school leaders who monitor teachers’ presence in the hallway before classes or who visit classes unannounced. He felt this level of scrutiny reflected administrators' belief that he was not motivated as a professional to do a good job.

The reflections of another second-career teacher, who had been in her position for more than six years, described how she perceived a lack of respect when she first arrived at her school. She commented, "I'll say one kind of an 'unglue like' thing, is when I first got there, the principal, even though I was a new teacher to the district, at no point in time said a word - said hello, -said absolutely anything to me."

As these examples illustrate, most teachers’ views on being treated as professionals resulted from negative experiences. However, two second-career teachers' comments addressed

positive experiences. In one case, a teacher had been asked to change schools because her expertise was needed at a different grade level. This example will be cited later in this discussion as an example of a teacher receiving recognition from school leaders. In the second case, a teacher explained that, through his first-career experiences in business, he was familiar with schools in which leaders showed respect for their teachers as professionals.

A second area of teachers' comments addressing the need for respect dealt with school administrators' *Leadership Style*. Approximately 18% of coded interview segments in the *Respect* category addressed *Leadership Style*.

Interviewees' comments suggested that they perceived an authoritarian leadership style as a lack of respect from school leaders. Six interviewees, two first-career teachers and four career-changers, described conditions they found troubling. These conditions ranged from "top-down management" to angry confrontations by school leaders. For example, a career-changer used these words to describe the leadership style in his school, "Top-down, very little from the bottom up, and yet, it's like everything is on the teachers, on the teachers." A first-career teacher summarized her experiences in this way, "It's more of … 'This is what we're doing,' and not, 'Where do we want to go?' It's very pre-determined." These teachers' comments also reveal their desire to be heard and to contribute to the school's progress; these factors comprise the third subcategory the researcher identified as reflecting a need for respect, *Teacher Input*.

The researcher coded interview segments that referred to leaders' use of teachers' ideas, concerns, suggestions, or feedback in the subcategory, *Teacher Input,* which accounted for approximately 19% of the coded segments for *Respect*. The importance of teacher input, and the way that school leaders use that input, was apparent in the comments of five interviewees, two first-career teachers and three career-changers. The coded text segments showed that while

teachers valued being asked for their input, it was equally important to have their input acknowledged, recognized, and used for decision-making. Teachers who believed leaders had ignored or disregarded their input expressed feelings of disrespect. The resultant negative effect on teachers' commitment is illustrated by a second-career teacher's remarks, "I will never, ever take part in anything like this again. Because, no matter what we do, they're just letting us talk to placate us." Frustration was also evident in a first-career teacher's reflections about the self-assessment work done by the school's faculty for the high school's accreditation: "…none of us have seen any of that work be put into practice at all. So, we are regularly asked to go through our areas of weakness, and assess, and then it's just left."

The negative experiences described by some teachers contrast with those of a first-career teacher whose input was welcomed immediately upon her arrival. She explained, "They also treated you like you have your own expertise. You come in with your own ideas … 'We could teach this, this way, and we could teach this, this way.' And they'd respect and appreciate that expertise, too."

A career-changer also expressed how she felt leaders are receptive to teacher input,"… taking the time to listen to concerns that the staff may have as well." Another interviewee described teachers' participation in curriculum development:

> We have been asked to participate in curriculum development. So, we don't have complete control over what gets done, of course there are standards and stuff we have to go by, but the good thing is there are opportunities to be on development teams. Even … in my first couple of years, I was invited to help develop some of the common course assessments. … You have some degree of design in what you are teaching.

Thus, the experiences described by five interviewees suggest that authentic involvement of teachers in school decision-making may enhance their commitment.

The fourth subcategory the researcher established to classify interviewees' comments related to *Respect* is *Recognition from Leaders*. Coded interview segments were placed in this subcategory if teachers referred to positive feedback or an acknowledgment regarding the quality of their work or if a teacher mentioned rewards. *Recognition from Leaders* accounted for approximately 10% of the *Respect* codings.

While three interviewees described conditions reflecting a lack of recognition, two described cases in which their skills or expertise were recognized. For instance, a first-career educator explained that she had been recruited to teach in an alternative education program. The second case, which has been discussed previously in the subcategory *Professional Status,* was a second-career teacher who moved from a middle school assignment to a high school position at her school leaders' request, "We really need you up at this level."

Three interviewees, on the other hand, described a lack of recognition by school leaders. One teacher's frustration with his experiences is reflected in his comments, "There is never a 'Hey, good job!' or … 'I love what I heard you saying to that student!' They never catch you doing anything right. There is never any recognition of the faculty for … doing something well." Similar sentiments were evident in another teacher's remarks, "So it's just very damaging to morale to sit down and be told what a bad job you are doing on a very regular basis and very rarely get any praise for anything because, quite frankly, we work in a difficult district." Another teacher, with more than seven years' experience in her position, described how positive feedback and recognition could promote sustained effort by teachers:

> Finding a teacher to decorate the cafeteria or gym, you know, finding a teacher and actually saying to that teacher, "Your classroom is very beautiful, it's really aesthetically pleasing, can you potentially help us with the decorations?" Using that compliment to the teacher will build that teacher's confidence and make them feel good about themselves, and they will be more willing to do more work for you.

Ultimately, through their descriptions of both positive and negative scenarios, interviewees conveyed the importance of *Recognition* as a means of promoting teachers' commitment to their schools.

The researcher categorized interview segments that reflected teachers' need to feel valued by school leaders in the subcategory, *Appreciated by Leaders.* This subcategory, which includes 18% of the coded segments in *Respect*, may appear to be redundant when compared with *Recognition*, because in practice both may occur simultaneously. However, the distinction between these two concepts is important for the present discussion of conditions that build teachers' commitment to their school. In *The 5 Languages of Appreciation in the Workplace*, Chapman and White (2012) differentiate between recognition and appreciation:

> Recognition is largely about behavior. "Catch them doing what you want and recognize it," the books say. Appreciation, conversely, focuses on performance plus the employee's value as a person.
>
> Recognition is about improving performance and focuses on what is good for the company. Appreciation emphasizes what is good for the company and good for the person …(p.23)

Keeping this distinction in mind, the researcher assigned coded interview segments that conveyed leaders' encouragement, or leaders' understanding and value of teachers' time, effort, skills, knowledge, or experience to the subcategory, *Appreciated by Leaders.*

Five interviewees described examples in which appreciation by school leaders was lacking. For instance, a second-career educator described increasing demands on his time for new projects or programs in his school, “There just seems to be a lack of appreciation for how much time it takes and no sense of obligation to try to provide that time. That's been true of every school I've been in.” Another second-career teacher expressed similar feelings regarding science instruction:

> Then there is no realistic assessment of the time necessary to achieve the basic proficiency in delivering a moderate quality science experience. And so, you know, if there was any sense that the school sort of had a picture of that or gave some indication that it understood how much time was involved in that, that would certainly make me more interested in staying with the school.

Three teachers described examples of appreciation from school leaders. A first-career teacher explained the support that he enjoyed, "A lot of support and encouragement has been given with working with athletic teams, and for some of my zanier experiments they have been pretty supportive and encouraging." A career-changer's explanation of her commitment to her school included, "and that understanding," reflecting her feeling of being understood.

In addition to describing the need for appreciation by school leaders, interviewees expressed the importance of feeling appreciated by their colleagues. A first-career teacher, who had taught in the same school for more than 8 years, described the appreciation she felt from school leaders and her colleagues during her first few years of employment, “The faculty and

administration were very supportive. They looked out for you and made you feel appreciated even though you were the new person."

In differentiating between recognition and appreciation, Chapman and White (2012) mention the role of colleagues in fostering appreciation in the workplace. Their explanation is useful here to emphasize the importance of appreciation from colleagues:

> The relational direction of recognition is top-down, coming from leadership. Appreciation, on the other hand, can be communicated in any direction. Colleagues want to know how to encourage and support one another. (Chapman & White, 2012, p.23)

The researcher classified interview segments in which teachers discussed having their views, knowledge, or skills valued by their colleagues, as *Appreciated by Colleagues.* Through this classification process, *Appreciated by Colleagues* was assigned 4% of the *Respect* interview segments. Two teachers described the negative effects associated with a lack of appreciation by colleagues. The comments of a second-career teacher illustrate how a lack of appreciation can have a negative impact on a teacher's commitment to her school. "I find myself not learning from people and no one wanting to learn anything from me. So I don't feel valuable either. So that is the biggest glue that is missing." This teacher has confirmed that she is considering a move to a different teaching position.

Just as appreciation from colleagues and supervisors can foster commitment, monetary compensation can serve as a symbol of respect and appreciation and thereby enhance commitment. In their interviews of former teachers who left the classroom, Sparks and Keiler (2003) explain that low salary can signify a lack of community respect for teachers. This view informed the researcher's classification of coded interview segments in the subcategory, *Financial Rewards.* Interviewee's comments that implicitly or explicitly described compensation

as an indicator of the value of one's work were classified as *Financial Rewards*. Using this criterion, *Financial Rewards* received approximately 7% of the *Respect*-coded interview segments.

In this dissertation study, the link between salary and respect was evident in the remarks of four interviewees. One of these teachers, a first-career educator who was in her second year in her position, discussed the connection between salary and teacher retention during her interview:

> I think an over-all problem with teacher retention is often, "Is the bang worth your buck?" I am putting hours and hours of my life and lots of hard work into this, and the outcome is a relatively small paycheck. So, obviously for a lot of people, and there are a lot of people who work in urban school districts for a long time, it doesn't matter, and it shouldn't matter. However, in general, I think a lot of people might leave the urban setting in order to find a job where they are more highly rewarded for the work they put in.

Another first-career teacher contrasted the salary he receives as a teacher with his potential salary in a different field, "So when we are looking at teachers' pays, it pays substantially less than any other first year job I could have gotten…" He also placed salary in the context of annual school lay-offs due to uncertain budgets, "… and I got fired every year, that's a pretty bad one."

While the comments of these two teachers illustrate the role that salary can play in eroding one's commitment to a teaching position, another teacher's view illustrated how monetary compensation can encourage a teacher to remain in a position. Describing the federal loan forgiveness program, which offers up to $17,500 available to teachers in high-need settings,

she said, "Then, of course, the loan forgiveness is something else that is keeping me here and that is very attractive in terms of being in an urban school."

Efficacy. As illustrated in Figure 4.10, 39% of the coded interview segments related to teachers' commitment to their schools were classified in the category, *Efficacy.* The researcher classified interview segments in this category if the interviewee's comments suggested his or her desire to be effective or successful. For instance, the reflections of a first-career teacher, with nearly twelve years' experience in her school, illustrate the connection between *Efficacy* and commitment to a school setting, "I feel like I have a strong command over my classroom, over my teaching, … You know, I feel that I am good at what I do at this point. So, I am happy that way."

At the end of this classification process, all 12 interviewees had comments included in *Efficacy*. The widespread importance of *Efficacy* observed for this population of science teachers agrees with the work of Johnson & Birkeland (2003) whose study of 50 new teachers in Massachusetts showed that schools organized to support teachers' success showed higher retention rates than schools lacking such supports.

In the present study, the researcher used five subcategories to organize the comments of teachers relative to *Efficacy: Support from Leaders, Collegial Collaboration, Induction & Mentor Programs, Work Conditions, and Students.* Table 4.21 lists the classification criteria, code frequencies, and the number of interviewees for each of these subcategories.

Table 4.21

Classification Criteria, Code Frequencies, and Number of Interviewees in the Coding Subcategories for Efficacy

Subcategory	Content Criteria	No. of Codes/ Category Total	Code Frequency	No. of Interviewees
Support from Leaders	• Assistance/support regarding classroom management, student behavior, parental communication, curriculum, and instruction • Support for teacher's authority • Feedback about performance	37/107	35%	11
Collegial Collaboration	• Support from colleagues regarding classroom management, student behavior, curriculum, and instruction • "United front" • New teachers receiving extra support, feedback on performance, and help with policies and procedures • Teachers learning from each other, problem-solving, or sharing ideas; common planning time • When lacking, perceived as isolation	32/107	30%	11
Induction & Mentor Programs	• Mentor's characteristics, e.g. subject matter, frequency of meetings, level of involvement • Characteristics of orientation or induction programs • Differentiated supports for new teachers based on teachers' strengths and weaknesses	19/107	18%	6
Work Conditions	• Bureaucratic demands, e.g. reports for performance evaluations, grant requirements, documentation for field trips • Availability and access to facilities, supplies, or equipment • Adequate planning time	14/107	13%	7
Students	• Stress associated with student behavior or motivation • Meeting students' needs, working effectively with them; good rapport	5/107	5%	4

Note. Sum of percentages does not equal 100% due to rounding.

The main criterion used by the researcher to classify interview segments in the *Support from Leaders* subcategory was that a teacher's statement referred to leadership support in ways that the teacher perceived would help him or her to be successful as a teacher. Therefore, this subcategory included teachers' comments that addressed administrative support in the form of

- classroom management or student behavior issues
- communication with parents
- affirming a teacher's authority in front of his or her students
- providing feedback to the teacher about his or her performance

Based upon the code frequency of nearly 35%, *Support from Leaders* was the most frequent factor related to *Efficacy* mentioned by the interviewees in this study. This finding corroborates this study's survey results, which revealed that *Leadership* was the highest rated of the multi-item categories of retention and attrition factors. Eleven of the 12 interviewees in this study referred to support by school leaders as an important influence on teachers' commitment.

Nine of the 12 interviewees discussed inadequate support by leaders as a factor affecting their commitment; this group included all of the career-changers and two of the first-career teachers. For one of the first-career teachers, the lack of support was in the area of curriculum and instruction. She explained that, although she had the social support of her colleagues, she lacked adequate curricular support, because of the school's focus on classes that prepare students for statewide testing:

> But, my classes were not important and were not high on any of the administrators' radars, at all. … (It) was like the third year of *Needs Improvement*, so they were more concerned with the kids who were in biology and integrated science. You know, the freshmen and sophomores who are going to take the state test, who are going to

contribute to our test scores that are going to go to the state and federal government. This teacher's comments revealed how the lack of assistance with her classes contributed to a sense of isolation.

More often, teachers' comments about inadequate support from leaders focused on issues of student behavior and effective approaches to classroom management. One teacher described the effects of too little administrative support with classroom management early in a new teacher's experience, "We get very little support on that until it's way too late, and a complaint happens, and the administrator comes and sees your classroom out of control, and then you are in trouble."

This view is in sharp contrast to another teacher's reflections about the high level of support she feels she has received in her school regarding classroom management:

> The administration is very, very supportive of new teachers. I had some difficulty with the usual new teacher thing, controlling some of the classes, etc., and they went out of their way to make sure the discipline guy came down and read them the riot act and supported me like 100%, 200%. So a lot of things that were (problems) in the beginning aren't problems any more. It's mostly because they didn't, like, 'hang me out to dry.' They were very supportive.

Another teacher echoed these sentiments in describing why she decided to remain in a position in spite of early difficulties with classroom management:

> So some things that encouraged me to stay, where I was unfamiliar how to handle some of the population - like I said, I went to a private school, so we generally didn't have discipline issues, and that took me a while to figure out how to manage those. My

> department heads and assistant principals were supportive in helping me deal with students who were chronic discipline problems…

The reflections of these interviewees suggest that teachers assign a high priority to leadership support as a tool to establishing and maintaining effective classroom management, which they viewed as a prerequisite for effective classroom instruction.

Two first-career teachers' comments showed that school leaders' support could be important in helping teachers negotiate communication with parents. One of these teachers, who has been in her position for over eight years, summarized her thoughts in this way:

> The administration is very supportive of teachers, in general - whether it's discipline problems, when a parent wants to come in for a conference, for whatever reason. So the department heads and guidance counselors will back you up. You are not left hanging if you have an angry parent that you can't seem to appease.

The other first-career teacher, in her fifth year in her position, described the importance of leaders' support of teachers' communication with parents, but also highlighted the need for leaders to affirm teachers' authority:

> I think support from the administration is huge. Them supporting teachers and getting behind them especially with parent contact and student contact, and if teachers tell the kids that there is going to be a certain consequence, the administration needs to back that up.

The comments of these interviewees and others point to the importance of support from school leaders on a variety of the responsibilities and challenges teachers face. Considering both the code frequency and the number of interviewees represented, *Support from Leaders* emerged as a substantial factor in fostering teachers' commitment to their schools. This finding agrees

with the analysis of survey results, as well. As has been discussed earlier, *Leadership* received the highest perceived importance rating among the multi-item survey categories of retention factors (.76) and attrition factors (.73) in this study.

With 11 interviewees represented and approximately 30% of the *Efficacy*-coded interview segments, *Collegial Collaboration* emerged as a highly important factor contributing to teachers' commitment. As summarized in Table 4.21, the researcher assigned to this subcategory teacher comments that met at least one of the following criteria:

- described support from colleagues regarding classroom management, student behavior, or pedagogy
- addressed teachers as a cohesive group or "united front"
- referred to extra assistance new teachers received from colleagues (separate from mentoring or induction programs)
- described teachers learning from each other, which might include common planning time
- when lacking, perceived as isolation

The comments of five teachers illustrated that inadequate collaboration could detract from a teacher's commitment, while the reflections of six teachers documented the benefits of collegial collaboration. A first-career teacher, who had been teaching for seven years, spoke of the lack of collaboration among teachers in her school: "That doesn't happen in my school. Doors are locked. People are not interested in having you find them out." By contrast, another first-career teacher explained that common planning time was part of the weekly schedule in her school, "I work with a group of people. We have collaboration twice a week," and another fist-career teacher described the schoolwide collaboration she has experienced, "We have a lot of

common planning time as a whole staff because there are so few of us." Still another interviewee's comments suggested both informal and formal times for collaboration, "We share everything that we do. So, if I make a work sheet, I send it out to all the integrated science group. 'Here you go, guys, if you want to use it, use it, if you don't want to, don't.' We have all the same tests, all the same quizzes. So everything is common for the entire sophomore class."

A second-career teacher summarized the importance of collaboration in this way, "It's the collaboration and support system they get from other teachers... I think that's the best thing to help retain teachers." A first-career teacher, who had described insufficient support during her first year of teaching, explained how important an improvement in support and collaboration was to her commitment, "…my department is actually the reason why I stay here now." A third interviewee, who is in her second year in her position, described the critical role of collegial support in her school setting:

> … having that support system at a school, as sometimes challenging as the school that I'm at, is really important. If I didn't have that connection with other staff members, I think my commitment to being at this position would be smaller.

The reflections of these interviewees spotlight the profound effect that collaboration and support from colleagues can have on teacher commitment.

The observations and analysis of interview data corroborate the survey findings of this study that were discussed earlier. The school conditions included in *Collegial Collaboration,* used for the analysis of interview data, correspond to factors that are addressed in the survey category, *Professional Community.* When survey data were analyzed, *Professional Community* ranked second to school leadership and as a retention factor (.73) also ranked second (.60) to *Leadership* as an attrition factor, along with *Science Factors(.61).*

As illustrated in Figure 4.10, *Induction & Mentor Programs* comprised a third subcategory of factors contributing to *Efficacy*. Table 4.21 lists the classification criteria used for this subcategory, the number of coded interview segments assigned to it, and the number of interviewees who discussed induction or mentor programs during their interviews. Approximately 18% of interview segments assigned to the *Efficacy* category were placed in *Induction & Mentor Programs,* and six of the 12 interviewees addressed such programs in their comments. The researcher placed coded segments in *Induction & Mentor Programs* if the teacher discussed the characteristics of either induction or mentoring efforts, or if the interviewee described the need for differentiated supports for new teachers.

Two teachers cited positive experiences with mentors. One of these teachers, a career-changer, explained that her mentor would regularly check in with her and offer her assistance. The other interviewee, also a second-career teacher, in her first year in her position, described her mentor as "phenomenal." Later in the interview, she went on to explain, "If I do have enough trouble with the kids, my mentor teacher, and this has happened only on one or two occasions, but he'll take him out of the classroom and go and work with him on something else."

Four interviewees, by contrast, described experiences with ineffective mentor or induction programs. For example, a career-changer explained her experiences in a previous school system in this way:

> … in my case, if I was in the same mentor scenarios such as the newbies that are fresh from the colleges, then I would be bored to tears. … That happened to me in my last school system. …. It was a waste of time, because I already had three years of experience going into that system; I already had a lot of what they covered.

Another second-career teacher echoed these sentiments in his comments:

> They form or pair you up with a mentor of some kind. And they have these programs, but they are very perfunctory, and they really just drain. They drain you rather than feed you. Because typically the person you are mentored with doesn't have any more time than you have, and frequently they are not helpful.

The comments of interviewees who have experienced ineffective mentor or induction programs illustrate the need for these programs to be responsive to teachers' specific needs. Some interviewees' reflections corroborate this observation. For instance, a teacher described the similarity between differentiated teacher supports and differentiated instruction for students: "Part of my training phase that I'm in right now is taking classes that are saying differentiate for your mentees as much as you differentiate for your students, which is true." This teacher's comments help to inform recommendations for school leaders addressed later in this dissertation.

The researcher established a fourth subcategory, *Work Conditions,* to classify interviewees' comments related to *Efficacy,* if they met at least one of three criteria:

- perceived bureaucratic requirements, such as paperwork or documentation
- availability and access to adequate facilities, supplies, or equipment
- adequate planning time

As shown in Table 4.21, the researcher assigned 13% of *Efficacy*'s coded segments to *Work Conditions*.

Four interviewees, all of whom had been in their positions for at least six years, commented on the increasing bureaucratic demands on teachers. An example of this viewpoint was found in the comments of a first-career teacher, who has been in her present position for more than seven years:

> I really enjoy teaching, but all the other stuff seems to really, more and more, get in the way, and it seems to not be just me, but teachers who have been teaching for a long time have considered leaving due to more paperwork for evaluation stuff, more common course assessments, common tasks.

Three teachers discussed other problematic work conditions. A career-changer, who is in his first year in his position, but who had previously taught in two other districts that he described as rural settings, reflected on work conditions with respect to his experiences teaching science:

> I'm answering this from the perspective of a science educator, the departments are perpetually underfunded. So, you are often in classes, in spaces, that are not appropriately designed for laboratory, and there is never a reasonable provisioning of materials, and there is never any flexibility in budgeting for you to procure materials during the course of a school year. So, there is a total lack of flexibility in what you can and can't choose to do while you are in the process of the year.

This teacher also described issues with scheduling science classes:

> Often there is haphazard scheduling having you teaching in different places back-to-back, that are far away or not near the resources, and that sort of impractical picture, over-all, just diminishes the quality of what you can bring. So …those types of issues being addressed would be … something that would make me feel better about what I'm doing on a day-to-day basis.

Other comments from interviewees ranged from positive conditions, such as small class sizes, to challenging conditions such as not having one's own classroom. However, with the exception of one teacher who said she left a position because she did not have her own

classroom, most teachers described poor work conditions as problems, but did not identify them as factors that would prompt them to leave a position.

The final subcategory the researcher created to organize interviewee's comments within *Efficacy* is labeled *Students*. This subcategory encompasses coded interview segments in which teachers described their feelings associated with students' behavior or motivation or associated with meeting students' needs, working effectively with them, or having a good rapport with them. These coded segments were placed in the *Efficacy* category rather that *Connections*, because they explicitly or implicitly referenced success as a teacher, rather than primarily addressing intrinsic rewards associated with teaching students. As shown in Table 4.21, four interviewees' comments were placed in this subcategory, and *Students* includes about 5% of the *Efficacy* codes.

Interviewees' comments assigned to the *Students* subcategory were positive in nature. For example, although a second career educator, in his third year in his teaching position, described stress associated with working with students who lacked motivation to study science, he concluded his remarks about the stressful conditions by describing his love for the work. Three other teachers indicated they felt effective in their work with students or had a good rapport with their students. One of these teachers, a career-changer, explained how her work as students' athletic trainer reduced the classroom management problems that new teachers typically meet:

> I saw the kids on another level. I was not just their teacher. I was also their athletic trainer, the one who was there, who watched all of their sports, who showed they cared about them on a different level.

In summary, this analysis of the coded interview data has highlighted five categories of conditions believed to contribute to teachers' commitment to their setting: *Safety, Identity, Connections, Respect, and Efficacy*. This review has also examined subcategories of factors the researcher established to better understand each of these categories. The analysis of interviews reveals the importance of school conditions that support *Safety* and, especially for career-changers, *Identity.* Furthermore, this analysis suggests that *Connections, Respect,* and *Efficacy* are powerful conditions that foster teachers' commitment.

Career Status vs. Retention and Attrition Factors: Research Question 2

The second guiding question for this study addressed the perceptions of first-career and second-career teachers regarding retention and attrition factors. The following supporting questions directed this analysis:

1. Are there significant differences between the perceptions of first-career and second-career teachers, in general, regarding retention factors and attrition factors?
2. Are there significant differences between the perceptions of first-career and second-career teachers, who are in their first three years in a position, regarding retention factors and attrition factors?
3. Do the perceptions of second-career teachers who have had 10 or more years in another career differ significantly from the perceptions of first career teachers?

Survey results. Figure 4.11 shows that slightly more than half (52%) of the survey participants were second-career teachers. The sample sizes for each group of participants differed for Part 2 (retention factors) and Part 3 (attrition factors). For Part 2 of the survey, there were 57 first- career respondents and 67 second-career respondents. For Part 3 of the survey, there were 52 first-career respondents and 65 second-career respondents.

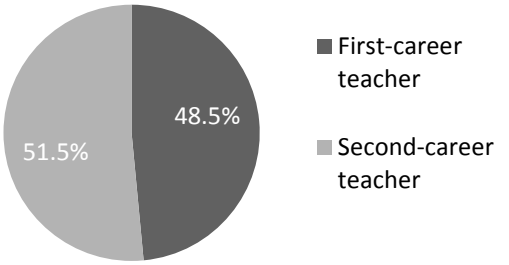

Figure 4.11. Percentages of first-career and second-career survey participants.

All participants. The responses of first-career and second-career teachers were compared to investigate differences in their perceptions of retention and attrition factors. Table 4.22 displays the mean responses for first-career and second-career participants for all eight multi-item categories, while Table 4.23 shows the mean responses for the single survey items that addressed retention and attrition factors.

Table 4.22

Mean Responses for Multi-item Categories of Retention and Attrition Factors for First-career and Second-career Teachers

	First-Career		Second-Career		
Retention Factor	N	M (SD)	N	M (SD)	Range
Leadership	57	35.32 (8.41)	67	35.70 (11.17)	7-49
Professional Community	57	32.75 (9.18)	67	34.75 (10.46)	7-49
Mentor Program	57	9.09 (8.01)	67	9.31 (9.91)	4-28
Science Factors	57	13.07 (5.45)	67	14.30 (5.66)	3-21
Attrition Factor					
Leadership	52	39.73 (10.11)	65	42.18 (10.36)	8-56
Professional Community	52	25.31 (8.34)	65	25.49 (9.04)	6-42
Mentor Program	52	10.25 (5.96)	65	11.85 (6.80)	4-28
Science Factors	52	12.46 (4.65)	65	12.95 (4.50)	3-21

Note. M is the mean perceived significance score for each category of retention and attrition factor.

Table 4.23
Mean Responses for Single Item Retention and Attrition Factors for First-career and Second-career Teachers

	First-Career		Second-Career	
Retention Factor	N	M (SD)	N	M (SD)
Induction Program	47	2.98 (1.96)	51	4.14 (2.23)
Autonomy	56	5.71 (1.51)	67	6.18 (1.32)
Attrition Factor				
No Induction Program	52	2.27 (1.66)	65	2.74 (1.99)
Lack of Autonomy	52	5.54 (1.63)	65	5.82 (1.46)

Note. M is the mean perceived significance score for each category of retention and attrition factor that range from 1 to 7.

The *t* test analysis for the eight multi-item categories of retention and attrition factors, shown in Table 4.24, revealed no significant difference (p = .05) between first-career and second-career educators' perceptions of the importance of these factors. Similarly, as shown in Table 4.25, no significant difference (p = .05) was observed between first-career and second-career teachers with respect to autonomy as a retention factor and with respect to induction programs and autonomy as attrition factors. However, a significant difference was observed between career status groups regarding induction programs as a retention factor (first-career = 2.98, second-career = 4.14, t = -2.723, p = .008). Because these results are based upon a single survey item, they are to be interpreted cautiously. However, they suggest that second-career teachers may value induction programs more highly than first-career teachers may. Furthermore, although not significant at the .05 level, autonomy was valued more highly by second career survey participants than by first-career teachers (first-career = 5.7, second-career = 6.18, t = -1.818, p = .07). Since this variable was measured with a single item, reliability is uncertain. However, these results suggest the need to investigate whether second-career teachers value autonomy or academic freedom more highly than first-career teachers do.

Table 4.24

t Test Results for Multi-item Categories: First-career and Second-career Teachers

		LT for EV		t-Test for Equality of Means					
Retention Factors		F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Leadership	Equal variances assumed	3.81	.053	-.214	122	.831	-.39	1.80	[-3.95, 3.18]
	Equal variances not assumed			-.219	120.30	.827	-.39	1.76	[-3.87, 3.10]
Professional Community	Equal variances assumed	1.20	.28	-1.117	122	.266	-1.99	1.78	[-5.52, 1.54]
Mentor Program	Equal variances assumed	6.51	.01	-.138	122	.891	-.23	1.64	[-3.47, 3.02]
	Equal variances not assumed			-.14	121.71	.889	-.23	1.61	[-3.41, 2.96]
Science Factors	Equal variances assumed	.12	.73	-1.225	122	.223	-1.23	1.00	[-3.21, .76]
Attrition Factors									
Leadership	Equal variances assumed	.12	.74	-1.287	115	.201	-2.45	1.91	[-6.23, 1.32]
Professional Community	Equal variances assumed	.005	.94	-.114	115	.910	-.18	1.63	[-3.40, 3.04]
Mentor Program	Equal variances assumed	.805	.37	-1.333	115	.185	-1.60	1.20	[-3.97, .78
Science Factors	Equal variances assumed	.07	.79	-.580	115	.563	-.49	.85	[-2.17, 1.19]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error, and CI is Confidence Interval.

Table 4.25

t Test Results for Single Item Categories: Comparison of First-career and Second-career Teachers

		LT for EV		t-Test for Equality of Means				
Retention Factors		F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Induction Program	Equal variances assumed	2.04	.157	-2.723	96	.008	-1.16	.42	[-2.00, -.31]
Autonomy	Equal variances assumed	2.19	.141	-1.818	121	.072	-.46	.26	[-.97, -.04]
Attrition Factors									
No Induction	Equal variances assumed	3.54	.062	-1.361	115	.176	-.47	.34	[-1.15, .21]
Lack of Autonomy	Equal variances assumed	1.18	.28	-.970	115	.334	-.28	.28	[-.84, .29]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error, and CI is Confidence Interval.

Teachers with three or fewer years' experience. Since new teachers in a school might perceive retention factors differently than experienced teachers, the responses of the thirty teachers who were in their first three years in a position were examined separately. In Tables 4.26 and 4.27, first-career and second-career teachers' mean scores for multi-item categories and single survey items are listed.

Table 4.26

Mean Responses for Multi-item Categories of Retention and Attrition Factors for First-career and Second-career Teachers in Their First Three Years

	First Career		Second Career		Range of
Retention Factor	N	M (SD)	N	M (SD)	Possible Scores
Leadership	17	36.82 (7.22)	13	40.31 (8.14)	7-49
Professional Community	17	32.82 (8.39)	13	36.00 (7.62)	7-49
Mentor Program	17	11.47 (7.69)	13	15.38 (9.25)	4-28
Science Factors	17	11.41 (5.46)	13	13.54 (6.29)	3-21
Attrition Factor					
Leadership	17	42.76 (8.30)	13	45.46 (6.33)	8-56
Professional Community	17	27.47(8.11)	13	25.62 (6.76)	6-42
Mentor Program	17	11.00 (6.54)	13	12.23 (6.27)	4-28
Science Factors	17	11.88 (4.12)	13	13.00 (4.30)	3-21

Note. M is the mean perceived significance score for each category of retention and attrition factor.

Table 4.27

Mean Responses for Single Item Retention and Attrition Factors for First-career and Second-career Teachers in Their First Three Years

	First Career		Second Career	
Retention Factor	N	M (SD)	N	M (SD)
Induction Program	16	3.88 (2.09)	13	4.15 (2.30)
Autonomy	17	5.29 (1.61)	13	5.46 (1.90)
Attrition Factor				
No Induction Program	17	2.47 (1.70)	13	2.77 (2.09)
Lack of Autonomy	17	5.65 (1.54)	13	5.62 (1.26)

Note. M is the mean perceived significance score for each category of retention and attrition factor that range from 1 to 7.

The *t* test analysis of the survey responses of teachers in their first 3 years of employment, shown in Tables 4.28 and 4.29, revealed that there were no significant differences ($p = .05$) in the mean responses of these first-career and second-career teachers. This is true for multi-item categories of retention and attrition factors as well as for those factors examined individually (*Induction Program* and *Autonomy*).

Table 4.28

t Test Results for Multi-item Categories: Comparison of First-career and Second-career Teachers in their First Three Years in a Position

Retention Factors		LT for EV		t-Test for Equality of Means					
		F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Leadership	Equal variances assumed	.105	.75	-1.24	28	.22	-3.48	2.81	[-9.24, 2.27]
Professional Community	Equal variances assumed	.16	.69	-1.07	28	.29	-3.18	2.97	[-9.26, 2.91]
Mentor Program	Equal variances assumed	.52	.48	-1.26	28	.22	-3.91	3.09	[-10.25,2.42]
Science Factors	Equal variances assumed	1.91	.18	-.99	28	.33	-2.13	2.15	[-6.53, 2.27]
Attrition Factors									
Leadership	Equal variances assumed	.64	.43	-.97	28	.34	-2.70	2.77	[-8.37, 2.98]
Professional Community	Equal variances assumed	1.28	.27	.67	28	.51	1.86	2.79	[-3.85, 7.56]
Mentor Program	Equal variances assumed	.68	.42	-.52	28	.61	-1.23	2.37	[-6.08, 3.62]
Science Factors	Equal variances assumed	.001	.98	-.72	28	.48	-1.12	1.55	[-4.29, 2.05]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error, and CI is Confidence Interval.

Table 4.29

t Test Results for Single Item Categories: Comparison of First-career and Second-career Teachers within their First Three Years in a Position

		LT for EV		t-Test for Equality of Means					
Retention Factors		F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Induction Program	Equal variances assumed	.74	.40	-.34	27	.74	-.28	.82	[-1.96, 1.40]
Autonomy	Equal variances assumed	.45	.51	-.26	28	.80	-.17	.64	[-1.48, 1.15]
Attrition Factors									
No Induction Program	Equal variances assumed	1.3	.26	-.43	28	.67	-.30	.69	[-1.71, 1.12]
Lack of Autonomy	Equal variances assumed	.08	.78	.06	28	.95	.03	.53	[-1.04, 1.11]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error, and CI is Confidence Interval.

Second-career teachers with 10 or more years' experience. Since second-career teachers, with many years' experience in their prior career(s), might have different perspectives on retention and attrition factors than first-career teachers, an analysis of these two subgroups was conducted.

Table 4.30 lists the mean responses of first-career teachers and second-career teachers with 10 or more years in a prior career to the multi-item categories of retention and attrition factors.

The *t* Test results for multi-item categories of retention and attrition factors are shown in Table 4.31 for the comparison of first-career teachers and second-career teachers with 10 or more years in a prior career.

Table 4.30

Mean Responses for Multi-item Categories of Retention and Attrition Factors for First-career and Second-career Teachers with 10 or More Years' Experience in Prior Career

	First Career		Second Career		Range of Possible Scores
Retention Factor	N	M (SD)	N	M (SD)	
Leadership	57	35.32 (8.41)	35	34.69 (13.52)	7-49
Professional Community	57	32.75 (9.18)	35	33.80 (12.12)	7-49
Mentor Program	57	9.09 (8.01)	35	10.11 (11.16)	4-28
Science Factors	57	13.07 (5.45)	35	13.49 (6.10)	3-21
Attrition Factor					
Leadership	52	39.73(10.11)	34	42.24 (11.89)	8-56
Professional Community	52	25.31 (8.34)	34	26.56 (9.94)	6-42
Mentor Program	52	10.25 (5.96)	34	13.76 (7.45)	4-28
Science Factors	52	12.46 (4.65)	34	13.47 (4.88)	3-21

Note. M is the mean perceived significance score for each category of retention and attrition factor.

As shown in Tables 4.30 and 4.31, when first career educators (M = 10.25) were compared with second-career teachers who had completed 10 or more years in a prior career(s) (M = 13.76), the multi-item category, *Mentor Program*, showed a significant difference as an attrition factor ($t(84) = 2.42$, p = .02). Calculation of Cohen's *d* (Becker, 2000; Salkind, 2011) revealed a medium effect size ($d = -0.53$) for this difference. This analysis indicates that negative experiences with a mentor program were perceived to be more important as an attrition factor by second-career teachers with 10 or more years in a prior career than by first-career teachers. Notwithstanding these findings, mentor programs were ranked least important of the multi-item categories of attrition factors in this study (Table 4.9).

Table 4.31

t Test Results for Multi-item Categories: Comparison of First-career and Second-career Teachers with 10 or More Years' Experience in a Prior Career

	LT for EV		t-Test for Equality of Means					
Retention Factors	F	Sig.	t	Df	Sig.	M diff.	SE diff.	95% CI
Leadership								
Equal variances assumed	15.30	.00	.276	90	.78	.63	2.28	[-3.91, 5.74]
Equal variances not assumed			.248	50.35	.805	.63	2.54	[-4.48, 5.74]
Professional Community								
Equal variances assumed	7.19	.01	-.469	90	.64	-1.05	2.23	[-5.47, 3.39]
Equal variances not assumed			-.439	57.84	.66	-1.05	2.38	[-5.81, 3.72]
Mentor Program								
Equal variances assumed	13.37	.00	-.513	90	.61	-1.03	2.00	[-5.00, 2.95]
Equal variances not assumed			-.474	55.55	.64	-1.03	2.16	[-5.36, 3.31]
Science Factors								
Equal variances assumed	.94	.335	-.339	90	.74	-.42	1.22	[-2.85, 2.02]
Attrition Factors								
Leadership								
Equal variances assumed	.58	.45	-1.05	84	.30	-2.50	2.39	[-7.26, 2.25]
Professional Community								
Equal variances assumed	.46	.50	-.63	84	.53	-1.25	1.99	[-5.20, 2.70]
Mentor Program								
Equal variances assumed	2.38	.13	-2.42	84	.02	-3.52	1.45	[-6.40, -.63
Science Factors								
Equal variances assumed	.136	.71	-.965	84	.337	-1.01	1.04	[-3.09, 1.07]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error, and CI is Confidence Interval.

Table 4.32 shows the mean responses of first-career teachers and second-career teachers with 10 or more years' experience in a prior career for the single item retention and attrition factors (*Induction Program* and *Autonomy*).

Table 4.32

Mean Responses for Single Item Retention and Attrition Factors for First-career and Second-career Teachers with 10 or More Years' Experience in Prior Career

	First Career		Second Career	
Retention Factor	N	M (SD)	N	M (SD)
Induction Program	47	2.98 (1.96)	26	4.73 (2.26)
Autonomy	56	5.71 (1.51)	35	6.09 (1.40)
Attrition Factors				
No Induction Program	52	2.27 (1.66)	34	3.21 (2.17)
Lack of Autonomy	52	5.54 (1.63)	34	5.97 (1.49)

Note. M is the mean perceived significance score for each category of retention and attrition factor that range from 1 to 7.

Table 4.33 presents the *t* Test results for the single item categories of retention and attrition factors for the comparison of first-career and second-career teachers with 10 or more years in a prior career.

Table 4.33

t Test Results for Single Item Categories: Comparison of First-career and Second-career Teachers with 10 or More Years' Experience in Prior Career

	LT for EV		t-Test for Equality of Means					
Retention Factors	F	Sig.	t	df	Sig.	M diff.	SE diff.	95% CI
Induction Program								
Equal variances assumed	.67	.42	-3.46	71	.001	-1.75	.51	[-2.76, -.74]
Autonomy								
Equal variances assumed	1.59	.21	-1.17	89	.244	-.37	.32	[-1.11, .26]
Attrition Factors								
No Induction Program								
Equal variances assumed	5.01	.03	-2.26	84	.026	-.94	.41	[-1.76, -.11]
Equal variances not assumed			-2.14	57.56	.037	-.94	.44	[-1.81, -.06]
Lack of Autonomy								
Equal variances assumed	1.60	.21	-1.24	84	.216	-.43	.35	[-1.12, .26]

Note. LT for EV is Levene's Test for Equality of Variance. SE is Standard Error, and CI is Confidence Interval.

As shown in Tables 4.32 and 4.33, the single-item factor, *Induction Program*, showed significant differences between first-career educators (M = 2.98 retention; M = 2.27 attrition) and second-career teachers who had completed 10 or more years in a prior career (M = 4.73 retention; M = 3.21 attrition). A significant difference was observed for *Induction Program* as a retention factor as well as for *No Induction Program* an attrition factor ($t(71) = -3.46$, $p = .001$ and $t(57.56) = -2.14$, $p = .037$, respectively). A large effect size ($d = -0.83$) was determined for *Induction Program* as a retention factor, and medium effect size ($d = -0.49$) was determined for *No Induction Program* as an attrition factor (Becker, 2000; Salkind, 2011). As previously stated, because a single survey item was used for induction programs as a retention and attrition factor, these results must be interpreted cautiously. Nevertheless, the data suggest a difference in perceived importance of induction programs for these two groups of teachers. It seems reasonable that second-career educators, who had experienced a prior career for many years, might value an induction program more highly than those who had prepared for teaching as their first career. It is important to note, however, that neither the first nor the second-career teachers ranked induction programs as a highly important retention or attrition factor (Table 4.10).

Interview Results for Research Question 2. Interview data suggest differences in the perceptions of first-career and second-career teachers regarding specific retention factors. For example, within the category of *Respect,* five of the six teachers who addressed the importance of being treated as professionals, were career changers. One of these second-career teachers explained her feelings in this way:

> Leaders need to understand that it's not about "Oh, I'm in charge now, therefore I'm the boss." People, I don't think, question if you are the boss or not, they question whether or not you are going to allow them to use their expertise.

Similarly, four of the five teachers who discussed recognition by school leaders were career-changers.

Leadership Style emerged as a factor affecting teachers' perception of being respected. Four of the six teachers who described negative effects of authoritarian leadership styles, were career-changers. For instance, a career-changer who was in his third year in his teaching position, described his preference for the collaborative management style he had experienced in business over the authoritarian leadership practices he had experienced in education.

Both survey and interview data confirm the important role of school leaders in fostering teacher retention. Interview results highlighted the importance of *Support from Leaders* to promote new teachers' effectiveness and success, labeled *Efficacy* here. Each of the second-career interviewees mentioned leaders' support, as did all but one first-career teacher.

Six teachers, five career-changers and one first-career teacher, discussed mentors or induction programs during their interviews. Furthermore, the need for differentiated supports in the form of *Induction & Mentor Programs* emerged as a noteworthy factor for second-career interviewees. Three of the twelve interviewees described this need, and each was a second-career educator, with many years' experience in his or her prior career. One of these teachers had worked previously in his own business for 20 years. He explained that when he began his teaching career, he had been treated as if he were a recent college graduate, in spite of his experience. These findings corroborate this study's survey results regarding induction programs and mentors, which showed a statistically significant difference in the perceptions of career-changers with at least 10 years' experience in another career and first-career teachers.

Interview results were less clear regarding the perceptions of first-career and second-career teachers about professional autonomy. Three interviewees described a lack of autonomy,

and two of these teachers were career-changers. Taken alone, these interview findings do not warrant a conclusion about differences between the two groups. Furthermore, this study's survey results indicated that autonomy was a factor of high importance to the participants, but statistical analysis did not reveal a significant difference between first-career and second-career teachers. Additional research regarding professional autonomy is warranted as will be addressed in Chapter Five.

The second subcategory of *Identity,* labeled *Experience* in this interview analysis, yielded unexpected results. Only three of the seven second-career interviewees referred to expertise or experience associated with their prior career in their *Identity*-related comments. These findings suggest that most of the career-changers in this study may not have felt a strong need to have their prior experiences recognized in their new role as science teachers.

The small interview sample size, five first-career teachers and seven career-changers, limits the credibility and generalizability of the comparisons of interview data for first-career and second-career teachers. Nevertheless, these results suggest some differences in the perceptions of first-career teachers and second-career science teachers in the areas of *Respect*, *Efficacy,* and, perhaps, *Identity*.

Recommendations for School Leaders: Research Question 3

Interview results. The third guiding question of this study addressed the conditions that school leaders can create to promote the retention of their science teachers. During the interview portion of this study, teachers were asked to recommend changes that school leaders might make to improve science teacher retention. In addition to their responses to this specific question, however, some teachers had offered suggestions while answering other interview questions.

As depicted in Figure 4.10, *Safety* is one of the factors that was shown to affect teacher commitment. Accordingly, three interviewees discussed the significance of a positive school climate. For example, a first-career teacher, who was in her second year of teaching, explained how important a positive and respectful school climate is to her:

> So students come into school, see school as important, and they see their teachers as people who should be respected and treated respectfully, and they act respectfully towards their peers and use appropriate language in school. That's all, in my mind, part of a positive atmosphere that makes learning and school a better place for students and teachers. So, if the administration is actively trying to create that atmosphere and maintain it, that's, in my mind, a really awesome aspect of the school.

Interviewees also highlighted the need for teachers to feel respected by school leaders. Seven of the interviewees addressed the importance of teachers being treated as professionals or being recognized for their work. For example, one second-career teacher, who had been teaching for eleven years, eight of which were completed in her present school, commented, "… in my mind it just goes to say treating people as a professional is one of the major aspects that the school leaders have to keep people teaching."

The second most common recommendation from interviewees was for school leaders to facilitate the collaboration of teachers. Five of the 12 interviewees recommended that school leaders foster collegial collaboration to improve teacher retention.

As discussed previously, *Collegial Collaboration* was categorized as affecting teachers' efficacy. Interviewees' comments reveal their perceptions about the relationship between collaboration and teachers' effectiveness. For instance, a first-career teacher who was in her second year of teaching, described her needs in this way:

> … having people being available to me that are well-versed in teaching science and have ways to support me that a typical administrator might not be able to do. You know, people that have been teaching science for a long time and have that bag of tricks to supply for me. I mean, this is my second year ever teaching, so to have that support from someone who knows what I'm going through in the science classroom and knows the content I am teaching, and has some ways to help me, in particular, to make myself a better science teacher… (That) might be something that would really help me feel more at home, and help me feel supported in a school, and make me want to stay in a school.

A second-career teacher, who had been in his present teaching position for only three months at the time of his interview, also emphasized the need for experienced science teachers to support newcomers:

> … providing science teachers time to meet together as colleagues, within the regular time frame, to work in more of a professional learning community type of framework, where you are meeting with colleagues who teach the same discipline, who have years of experience, so that you can learn from each other, so you can discuss and work with each other, and find what does and doesn't work. So, … making time for something like that would be more of a 'glue' for me.

While these two teachers described pedagogical assistance that can be obtained from collegial collaboration, another teacher focused on classroom management skills needed by new teachers. This first-career teacher, in his sixth year of teaching, described the need for collegial support by saying, “So in terms of supporting first year teachers, I would think a lot more access to veteran teachers on how to handle fairly minor discipline issues.” Each of these interviewees

has suggested that school leaders provide the time, venue, and encouragement needed for experienced teachers to foster the success of their new colleagues.

The primary recommendation made by 50% of the interviewees in this study was for school leaders to increase their support of new teachers. It is noteworthy that first-career and second-career teachers were represented equally in this recommendation. In particular, interviewees suggested that school leaders support new teachers' development of discipline and classroom management skills. However, instructional support was also mentioned, as is evident in this teacher's remarks, "… support with classroom management and behavioral support, as well as instructional support."

Both the survey and interview components of this study reinforce the primary role of school leaders in fostering science teacher retention. An interviewee suggested a paradigm shift in the way school leaders view their new teachers. This second-career teacher explained that the adjustment of new teachers to the profession needs to be a gradual process, and he suggested that new teachers be viewed, "as a developing resource." In his remarks, he contrasts what he perceives to be the present approach to new teachers' induction with an approach that would foster retention:

> … administration typically seems to have a "sink or swim attitude." It's kind of like they (expect) somehow you come into this system and already be what they need. So there is no attempt on anybody's part to look at you as a developing resource. It's more like, "Here is everything we are doing, see if you can do it, and we'll talk about whether or not you can stay around in April." So, as a new teacher, you have this overwhelming amount of new information and new skills you're supposed to be developing, and you don't have enough experience to know that it's impossible. There is just not enough time to do it all,

> and that you have to prioritize. It's tremendously stressful to, like, hold onto the idea that I'm actually supposed to do all this.

Therefore, this teacher asserts that, since it is not possible for the newcomer to embrace and be effective in every initiative and program within a school, it would be more reasonable, and less stressful, for novices to adopt the duties and responsibilities of a teacher gradually over an extended period.

Summary

This chapter has presented the analysis of survey and interview data for this study. Both quantitative and qualitative data highlight the importance of school leaders in building teachers' commitment to their schools and thereby fostering their retention. Both components of the mixed methods study also highlighted the important role of collegial collaboration and professional community in building teachers' commitment and promoting their retention. Survey results and the reflections of interviewees point to the importance of professional autonomy for teacher retention. Survey respondents rated mentor programs and induction programs of low significance as retention and attrition factors, and approximately 21% of survey respondents indicated that they did not have an induction program when hired.

An analysis of variance (ANOVA) revealed few differences in retention and attrition factor perceptions among age groups. Two differences were found between teachers 40 - 49 years old and teachers 30 - 39 years old in their ranking of attrition factors, specifically *Professional Community* and *Science Factors*. The 40 to 49 year-olds also differed from the under-30 age group in their perceptions of *Science Factors* contributing to their decision to leave a teaching position. In each of these cases, the 40 to 49 year-olds ranked these attrition factors higher than their younger counterparts did.

In general, teachers' responses to survey items did not differ with respect to gender or career status. An exception to this was found between first-career teachers and second-career teachers who had spent 10 or more years in their prior career. Career-changers who had at least 10 years' experience in a prior career ranked mentor program characteristics as a more important group of attrition factors than did first-career survey participants. Additionally, this same group of career-changers ranked induction programs of greater importance to their retention and attrition than did the first-career teachers.

Two open-response items in the online survey asked participants to describe retention and attrition factors that had not been addressed by the ranking questions in Parts 2 and 3 of the survey. Nearly half of the survey respondents elected to answer these questions. Teachers identified *Financial Factors* and *Students* most often as important retention factors. Regarding factors that contribute to a teacher's decision to leave a position, respondents mentioned *Financial Factors* and *Workload* most frequently.

Interview results suggest differences between first-career and second-career teachers regarding specific subcategories of *Respect* and *Efficacy.* In particular, regarding *Respect,* second-career interviewees valued being treated as professionals, receiving recognition from school leaders, and working with leaders who embrace a non-authoritarian style of leadership. Interview results also suggest that career-changers desire differentiated supports rather than standard induction and mentor programs.

When interviewees were asked to make recommendations to school leaders that would enhance teacher retention, their responses correlated with the retention and attrition factors they had identified in the survey and interviews. In particular, they recommended that school leaders

provide support for new teachers, especially regarding student behavior and classroom management, and that they foster collegial collaboration for new teachers.

The next chapter summarizes the findings of this study and presents conclusions. The researcher discusses the study's limitations and offers recommendations for future studies.

CHAPTER FIVE: DISCUSSION AND CONCLUSIONS

Teacher retention has been a persistent concern in American public education, especially in urban settings. Although numerous studies have addressed this concern from a variety of perspectives, schools continue to face challenges with teacher retention. Research has shown that teacher retention issues vary with subject matter (Baker & Keller, 2010; Clotfelter et al., 2008; Ingersoll, 2011; LaTurner, 2002; Moscovici, 2009; Ng & Peter, 2010) and school location (Andrews & Donaldson, 2009; Ingersoll, 2001, 2003, 2011; McKinney et al., 2007; Watlington et al., 2010). Turnover rates are particularly problematic for teachers of mathematics and science (Baker & Keller, 2010; Clotfelter et al., 2008; LaTurner, 2002; Ng & Peter, 2010). Faced with a demanding work environment, urban schoolteachers show higher attrition rates than do teachers in non-urban school environments (Brown, 2003; Donaldson & Johnson, 2011; Marvel et al., 2007; Watlington et al., 2010).

This study focused on the retention of science teachers in urban area high schools in New England by examining teachers' perceptions of school conditions that promote their retention and conditions that may contribute to their attrition. Three research questions framed this study:

1. What are the conditions necessary to retain new science teachers in urban area high schools?
2. What are the similarities and differences in retention-promoting factors and attrition factors between first-career and second-career science teachers?
3. How do urban school leaders create the necessary conditions to foster retention of quality science teachers?

Context of the Study

In order to establish a conceptual background for this study, literature was examined regarding (1) teacher retention, with an emphasis on science teachers and urban settings, (2) career-changers in education and relevant applications of adult learning, (3) employee retention generally, and (4) characteristics of effective school leaders.

This review of the literature on teacher retention highlighted several factors that seem to promote teacher retention or contribute to attrition. Chief among these factors are characteristics of school leadership (Andrews et al., 2012; Angelle, 2006; Certo & Fox, 2002; Ingersoll, 2001, 2011, 2012; Johnson & Birkeland, 2003; Ladd, 2011; Loeb et al., 2005;Smith & Ingersoll, 2004). For instance, supportive school leaders have been shown to foster retention (Johnson & Birkeland, 2003), while a "top-down" leadership approach has been reported to contribute to teacher dissatisfaction (Certo & Fox, 2002). Collaboration among teachers has also been shown to strengthen teacher retention (Andrews et al., 2012; Certo & Fox, 2002; Johnson & Birkeland, 2003), as have mentor programs and induction programs, generally (Brown, 2003; Ingersoll, 2012; Kelley, 2004; Smith & Ingersoll, 2004). Salary and other financial benefits, can contribute to, or detract from, a teacher's satisfaction with his or her place of employment, and thereby affect retention. Depending on the nature of the incentive, monetary factors have shown mixed results as tools to promote long-term teacher retention (Clotfelter et al., 2008; Donaldson & Johnson, 20011).

Other retention factors that have been identified in the literature are beyond the immediate influence of school leaders to effect change. For example, pre-service training, by affecting teachers' preparation for employment, can also influence their retention (Andrews & Donaldson, 2009; Baker & Keller, 2010; Donaldson, 2009; Donaldson & Johnson, 2011;

Jorissen, 2003; Kirchhoff & Lawrenz, 2011; Taylor and Frankenberg, 2009). Because features of teachers' pre-service training are beyond the control of school and district leaders, teacher education programs were not included among the factors addressed in this study. Nevertheless, some of this study's findings may be informative for the design of effective pre-service programs, and related recommendations for future research will be noted later.

Bearing in mind the criterion of school leaders' capacity to execute change in their school environments, this study sought to identify the conditions urban area school leaders could create to foster retention and mitigate attrition of their science teachers. The literature review strongly suggests that school leadership, professional community, and mentor programs are major considerations in engendering teacher commitment and retention. Therefore, these factors were highlighted in this study.

A second objective of this study was to compare the perceptions of first-career teachers with the perceptions of career-changers about conditions that promote retention or may fuel attrition. Data from the National Center for Education Information (NCEI) (2011) reflect a growing number of second-career science teachers. NCEI data show that more biology, chemistry, physics, and general science teachers followed an alternative pathway to teaching than followed a traditional teacher preparation route; many of these alternatively prepared teachers are likely to be career-changers. In fact, the NCEI (2011) has recommended, "Recruiting individuals from other careers into teaching and school administration" (p. ix) to strengthen the profession.

The rationale for comparing first and second-career science teachers in this study was twofold. First, the well-established trend of career-changers in science education is likely to continue. Given the low numbers of undergraduate science majors (Aud et al., 2012), an

adequate supply of first-career secondary school teachers is improbable. Attractive salaries in other science and engineering careers lure many science undergraduates to fields other than education. Therefore, the career-changer trend in science teaching can be expected to continue.

The second impetus for this study was to identify differences in the perceptions of career-changers that might warrant adjustments in retention efforts. Considering the differences in life experience and professional knowledge and skills between first and second-career science teachers, the conditions that foster or diminish their desire to remain in a teaching position might vary. Therefore, this study sought to determine if there were important differences in perspectives of these two career status groups.

Study Design

While *Leadership*, *Professional Community*, and *Mentor Programs* were the study's main categories of retention and attrition factors, science instruction parameters, or *Science Factors*, (laboratory safety, supplies and materials, and time for lab instruction), *Autonomy*, and *Induction Programs* were included in the inquiry as well.

The participants for the study were public high school science teachers in New England. The purposeful sample for this study included high school teachers from communities labeled *Large Cities, Midsize Cities, Small Cities, and Large Suburbs* in the 2009-2010 and 2010-2011data bases of the National Center for Education Statistics (NCES) (Institute of Education Sciences, 2012). The schools that were selected from these communities had at least 50% of the student body qualify for the Free and Reduced-Price Lunch (FRPL) Program. In New England, only Connecticut, Maine, Massachusetts and Rhode Island had schools that met both of these criteria.

For this study, the researcher used a sequential mixed methods approach (Denscombe, 2010). Quantitative and qualitative data were obtained through an online survey, and additional qualitative data were acquired by interviews. The survey items were developed by the researcher to reflect retention and attrition factors described in the literature (see Appendix F). Approximately 695 survey invitations were sent by e-mail to science teachers in the selected New England high schools. One hundred thirty-eight science teachers took the survey, and nearly 82% of those who began the survey completed it. Survey participants were asked to provide demographic information and employment information, including their first-career or second-career status. Two sections of the survey consisted of items that asked respondents to rank the significance of retention factors and attrition factors. Two open-response survey items provided qualitative data by inviting participants to describe important retention or attrition factors not addressed by the survey. However, the primary source of qualitative data consisted of 12 interviews of teachers who had volunteered at the time of their survey responses. Eleven of the 12 interviews were conducted by telephone; one interview was done in person at the teacher's request. The interviews, from 18 to 45 minutes in length, were digitally recorded and subsequently transcribed.

Quantitative data analysis of retention and attrition factors involved four main parts: (1) examination of the relative significance of factors using percent total score, (2) a comparison of factors among age groups of teachers (ANOVA), (3) a comparison of factors between genders (*t* test), and (4) a comparison of factors between first-career and second-career teachers (*t* tests). Part 4 of the retention and attrition factor analysis, which focused on first-career and second-career teachers, compared three different sets of participants: (1) all survey participants, (2) only participants in their first three years in a position, and (3) all first-career teachers and only

second-career teachers with 10 or more years' experience in a prior career. Each of the comparisons of first-career and second-career teachers used a *t* test analysis.

Qualitative data analysis included a review of teachers' responses to two open-response items on the online survey as well as an analysis of the 12 interview transcripts. Survey participants' answers to the open-response items identified retention and attrition factors that participants believed were important to them, but had not been addressed by the survey. The researcher coded their responses and subsequently identified categories that emerged from the data. The analysis of these data resulted in a ranked list of retention and attrition factors based upon their frequency in teachers' responses.

The researcher coded the interviews using an iterative process of coding and category development. As a validity measure, three educators, recruited independently of the study population, each coded four of the transcripts so that the researcher could compare her code assignments for each of the twelve interview transcripts with the coding of an independent reader. Generally, the codes assigned by the researcher and the independent readers matched. When a coded section did not match the researcher's code assignment, she evaluated the code choice and followed one of the three following protocols:

1) retained the reader's assigned code, if it was confirmed to be the more authentic match,

2) retained the researcher's code, if it was determined to be the more authentic match,

3) collapsed codes that were redundant.

In some cases, segments of a transcript were coded by either the researcher or the independent reader, but not both. The researcher evaluated each of these coded segments and followed steps 1 and 2 above to finalize coding. Once codes assignments were confirmed and the codebook

adjustments were made, the researcher evaluated emergent themes to interpret the qualitative data.

Quantitative data and qualitative data were analyzed within the framework of this investigation's three guiding questions. Both types of data were interpreted independently and collectively to produce the findings of the study.

Discussion of Findings

Relative importance of retention and attrition factors. This investigation set out to identify the most significant retention and attrition factors as perceived by science teachers in urban area New England high schools. The researcher employed a mixed methods approach that enables triangulation of data to reduce validity threats (Denscombe, 2010; Maxwell, 2005). To illustrate the connections among the components of the study, Table 5.1 summarizes its key findings regarding conditions affecting science teacher retention and identifies the quantitative and qualitative data supporting each finding.

Considerable research has highlighted the role of school leaders in promoting teacher retention (Angelle, 2006; Andrews, et al. 2012; Certo & Fox, 2002; Ingersoll, 2001; Ingersoll, 2011; Johnson & Birkeland, 2003; Ladd, 2011; Stevenson, et al. 2000). Both the quantitative and qualitative results of this study confirm the predominant role of school leaders in fostering the retention of their science teachers.

Table 5.1

Summary of Key Findings: Perceived Importance of Retention and Attrition Factors Among Science Teachers in Urban High Schools (Research Question 1)

Finding	Data from Survey Items	Data from 2 Open-Response Items	Data from 12 Interviews
Through a variety of influences, including their respect and support of new teachers and leadership style, school leaders emerged as the predominant retention factor for science teachers in urban area schools.	✓	✓	✓
Professional community, evidenced by camaraderie, collaboration, support, and cooperation among teachers, was regarded as a highly important retention factor, second to school leadership.	✓	✓	✓
Science teachers perceived science instruction factors, such as laboratory safety, adequate supplies, and equipment, as important retention factors.	✓	✓	✓
Mentor programs emerged as the least important category of factors affecting science teacher retention.	✓	N/A	✓
Induction programs were not perceived as a significant retention factor.	✓	N/A	✓
Professional autonomy emerged as a very important retention factor.	✓	✓	✓
Female and male science teachers did not differ in their perceptions of retention and attrition factors.	✓	N/A	N/A
Science teachers of different age groups may differ in their perceptions of professional community and science instruction factors, with younger teachers assigning a lower value to these factors than teachers who are between 40 and 49 years old.	✓	N/A	N/A
Financial factors are important considerations affecting science teachers' decisions to stay or leave a position.	N/A	✓	✓
Science teachers' positive feelings toward their students are important factors contributing to their decisions to stay in their teaching positions. (includes altruistic motivations)	N/A	✓	✓
Science teachers' decisions to remain in a position are influenced by personal factors.	N/A	✓	N/A
Science teachers are influenced by their perceived workload in their decision to leave a position.	N/A	✓	N/A

Note: ✓ indicates corroborating data. N/A (Not Applicable) indicates the topic or factor was not addressed by a component of the study.

Table 5.2 lists the survey items included in the *Leadership* category of retention and attrition factors. As shown in Table 5.2, items in Parts 2 and 3 of the survey examined a variety of school leadership characteristics, including respecting and appreciating teachers, relational trust, school climate, and valuing teacher input for decision-making. During statistical analysis, the items within each category were combined to improve reliability.

Table 5.2

Survey Items Addressing Leadership

Survey Section	Item	Content
Part 2 - Retention		School leader(s) who…
	9	Values and respects teachers
	10	Wants teachers' success
	16	Treats teachers as professionals
	19	Maintains a safe school climate
	20	Seeks teacher input
	21	Provides consistent and supportive feedback
	31	Values science instruction
Part 3 – Attrition		Teachers perceive…
	32	Lack of respect
	33	Lack of clarity on leader's views
	35	Leader does not value teacher's work
	36	Potential negative consequences for expressing opinions
	42	Lack of safety due to school climate
	43	Input not valued
	54	Leaders do no value/appreciate science

Interview data from this study corroborate the results of other research citing school leaders' support of new teachers in fostering retention (Certo & Fox, 2002; Ingersoll, 2001, 2011; Johnson & Birkeland, 2003; Ladd, 2011; Tillman, 2005). Notably, interviewees' comments highlighted the importance of teachers' feeling appreciated and respected by school leaders, which included their desire to be treated as professionals. Interview data showed that teacher efficacy was of prime importance to teachers' commitment to the school. Within this category of

factors, teachers' need for school leaders to support them, especially with regard to classroom management, was evident.

Professional Community was a second major category of retention and attrition factors addressed in the online survey. This category of survey items, summarized in Table 5.3, included several items that addressed social considerations and collegial collaboration among science teachers.

Table 5.3
Survey Items Addressing Professional Community

Survey Section	Item	Content
Part 2 - Retention	11	Collaborate about lesson planning
	13	Collaborate about laboratory instruction
	15	Camaraderie
	17	Colleagues want teacher's success
	24	Collaborate about student achievement
	27	Collaborate about student discipline
	28	Respected by colleagues
Part 3 – Attrition		Teachers perceive…
	34	Lack of collaboration regarding lessons
	37	Isolation
	40	Lack of collaboration regarding lab instruction
	47	Lack of collaboration regarding student achievement
	50	Lack of collaboration regarding student discipline
	51	Lack of respect from colleagues

Survey participants ranked *Professional Community* as the second highest category of retention factors, and, regarding attrition factors, equal to *Science Factors*, which will be discussed later. As summarized in Table 5.1, the results from teacher interviews corroborate these quantitative data. Interviewees expressed their desire to be appreciated by their colleagues, to have a sense of camaraderie with them, and to have a shared vision with them and with school leaders. Furthermore, their need to receive support and collaborate with colleagues was of high importance in its contribution to their efficacy. These results are in agreement with prior

research that has documented the importance of collegiality and collaboration for new teachers (Andrews et al., 2012; Anhorn, 2008; Johnson & Birkeland, 2003; Smith & Ingersoll, 2004).

The survey results showed that the participants in this study also assigned high importance to factors associated with effective science instruction. Table 5.4 lists the survey items that addressed conditions labeled *Science Factors* for this study.

Table 5.4

Survey Items Addressing Science Factors

Survey Section	Item	Content
Part 2 - Retention	12	Laboratory safety
	14	Sufficient time for lab investigations
	30	Adequate lab supplies and equipment
Part 3 – Attrition	39	Insufficient time for lab investigations
	41	Laboratory safety not a priority
	53	Inadequate lab supplies and equipment

Science teachers who completed the survey ranked these science instruction factors as the third most important category of retention factors and equal to *Professional Community* as attrition factors. The 12 teachers interviewed in this study described problems they had encountered regarding work conditions, including not having an assigned classroom, but the conditions addressed by the survey items were not widely mentioned by interviewees. Nevertheless, survey participants' responses to the two survey open-response items, placed *Science Factors* as one of the top five retention factors and one of the top four attrition factors. Work conditions, such as the quality and availability of supplies and facilities, contribute to teachers' efficacy, a very important aspect of building teachers' commitment to a school setting. Other studies have suggested that adequate supplies and suitable facilities are factors that influence teacher turnover (Loeb et al., 2005; National Research Council, 1992).

The survey addressed *Mentor Programs* using four items for retention factors and for attrition factors. Table 5.5 identifies the items in the *Mentor Programs* category and the single items that addressed *Induction Programs*.

Table 5.5

Survey Items Addressing Mentor Programs and Induction Programs

Survey Section	Item	Content
Part 2 - Retention		
Mentor Program	18	Regular meetings with mentor
	23	Mentor teaches same subject
	25	Mentor wants teacher's success
	26	Mentor visits classes
Induction Program	22	Orientation or induction program
Part 3 – Attrition		
Mentor Program	38	No assigned mentor
	46	Mentor teaches different subject
	48	Mentor seldom meets with mentee
	49	Mentor does not visit classes
Induction Program	45	No orientation or induction program

Survey responses suggested that many participants did not have an assigned mentor, or had ineffective mentoring experiences. In fact, over 40% of survey respondents either did not have an assigned mentor or had participated in a mentor program that lacked key components, such as opportunities to meet with one's mentor. Similarly, about 21% of survey participants indicated that they had not received an induction or orientation program. These findings seem to be in contrast with the widespread use of induction and mentoring programs reported in the literature. For example, through an examination of twenty years of national data, Ingersoll (2012) reported that 90% of teachers had received some type of induction program in 2008 compared with 51% during the 1990-1991 school year.

Mentor programs ranked last in perceived importance among the multi-item categories of retention and attrition factors in this survey. In addition, interviewees described negative

experiences with mentoring and induction programs more often than positive ones. Because previous studies have documented the benefits of quality mentor and induction programs (Alliance for Excellent Education, 2008; Brown, 2003; Ingersoll, 2012; Ingersoll & Kralik, 2004; Jorissen, 2003; Santovec, 2010; Shockley et al., 2006; Smith & Ingersoll, 2004), the low ranking of mentor and induction programs in this study was unexpected. However, this low ranking may be understood in the context of studies that have shown a link between the efficacy of induction and mentoring programs and specific program features. For example, Long and colleagues' (2012) literature review of induction and mentoring programs documented the variation in particular features and comprehensiveness among schools' programs and raised questions about the connection between these programs and teacher retention.

The extremely low survey rating for the *Mentor Program* category, both as a retention factor and as an attrition factor, warrants further analysis. Forty-eight percent of the 118 teachers who answered a survey item on the importance of having an assigned mentor for their attrition decisions, assigned the lowest significance rating (1) to this item. These findings raise serious concerns about the quality of mentor programs in the schools that participated in this survey.

A solid research base supports the correlation between the comprehensiveness and quality of induction and mentoring programs and teacher retention (Alliance for Excellent Education, 2008; Darling-Hammond, 2003; Ingersoll, 2012; Shockley et al., 2006; Smith & Ingersoll, 2004). To understand the relationship between teacher retention and induction, including mentoring, programs, it may be useful to employ the paradigm of *form follows function* (Lidwell, Holden, & Butler, 2010). In other words, the identified needs of new teachers must inform the design of induction and mentoring programs. That is, the *form* of the program must be determined by its *function.* The results of the present study suggest that the induction and mentor

programs experienced by the study's participants had not been tailored to their needs. This may be especially true for new career-changers, as will be discussed later.

The last retention factor to be addressed in this summary is *Autonomy,* a factor that produced noteworthy survey results. Table 5.6 lists the items in the online survey that addressed *Autonomy*. The overall survey rating of *Autonomy*, as a retention factor and an attrition factor, was quite strong.

Table 5.6

Survey Items Addressing Professional Autonomy

Survey Section	Item	Content
Part 2 - Retention	29	Freedom regarding instruction and assessment
Part 3 – Attrition	52	Limited freedom regarding instruction and assessment

Although the survey's finding of *Autonomy's* perceived importance must be interpreted with caution because of its reliance on data from single survey items, qualitative data from survey open-response items and from interviews reaffirm its import for the science teachers in this study. Professional autonomy was one of seven conditions cited most often as a retention factor in the survey's open-response item. Interview results also suggest the importance of autonomy as a factor contributing to teacher retention. Five of 12 interviewees explained how a lack of professional autonomy detracted from their commitment to their positions. In this study, *Autonomy* is interpreted as a component of *Identity,* a category of factors that contribute to a teacher's commitment by honoring and protecting an individual's characteristics, values, and creativity, and embracing the individual as part of the school organization.

This study's findings regarding science teachers' perceived importance of autonomy for their employment decisions is especially interesting in light of published research. In a recent

study of mathematics and science teacher retention, which used the NCES 2003-04 Schools and Staffing Survey (SASS) and the 2004-05 Teacher Follow-up Survey (TFS), Ingersoll and May (2012) reported lower teacher turnover in schools with higher levels of teachers' classroom autonomy. This relationship was especially strong when the analysis used the overall autonomy rating provided by teachers in the school rather than the ratings of individual teachers, suggesting a connection to organizational characteristics of schools. When the views of mathematics teachers and science teachers were disaggregated, however, the relationship between autonomy rating and turnover was very strong for mathematics teachers, but not strong for science teachers (Ingersoll & May, 2012). In fact, their analysis showed that the maximum salary offered by a school district was the strongest factor associated with science teacher turnover (Ingersoll & May, 2012). Considering these recently published findings, the results of the present study are particularly interesting. Questions arising from this contrast in results will be discussed later.

Gender and age considerations. This study did not reveal significant gender differences in the ranking of retention and attrition factors in the population of science teachers who participated in the online survey. In addition, differences among age groups of teachers (< 30, 30-39, 40-49 and > 50 years old) were few. The participants in the 40 to 49 year-old group showed significant differences in their higher ratings of *Science Factors* and *Professional Community* compared to younger groups of participants. It is important to note that there was considerable variation in rankings of factors within age groups, therefore an ANOVA could not be performed for most factors.

Career status. Career-changers were of particular interest in this study. In response to Research Question #2, Table 5.7 lists this study's key findings regarding the perceptions of first-career and second-career science teachers.

Table 5.7

Summary of Key Findings: Comparisons of First-Career and Second-Career Science Teachers' Perceptions of the Importance of Retention and Attrition Factors (Research Question 2)

Finding	Data from Survey Items	Data from 2 Open-Response Items	Data from 12 Interviews
Career-changers (especially those who have had many years' experience in a prior career) valued induction experiences more strongly than first-career teachers did.	✓	N/A	✓
First-career teachers and career-changers with many years' experience in a prior career differed in the importance assigned to mentor programs.	✓	N/A	✓
Second-career teachers described the importance of collaborative, supportive, and respectful school leaders who treat teachers as professionals more often than did first-career teachers.	N/A	N/A	✓

Note: ✓ indicates corroborating data. N/A (Not Applicable) indicates the topic or factor was not addressed by a component of the study.

The literature review for this study suggested that the perspectives of first-career and second-career science teachers might differ (Etherington, 2011; Resta, et al., 2001). Differences in worldviews of career-changers, for example, might affect pedagogy (Etherington, 2011) and the different skill sets and experience of career-changers might warrant specialized pre-service training (Sawchuk, 2008).

Data from this study's online survey items suggest that first-career and second-career teachers may differ in their evaluation of induction programs and mentor programs. Second-career science teachers, who had completed 10 or more years in a prior career(s), assigned a higher importance value to induction programs, as retention and attrition factors, than did first-career teachers. Second-career science teachers with many years' experience in a prior career also differed from first-career teachers in their perceptions of mentor programs. This group of

experienced career-changers assigned a higher importance value to *Mentor Program* as an attrition factor than did first-career teachers. Although the importance ratings for *Induction Program* and *Mentor Program* were not commensurate with ratings for categories such as *Leadership* and *Professional Community*, the observed statistically significant difference between first-career teachers and this subset of experienced career-changers on these factors is noteworthy.

It may be useful to interpret the difference in perceived importance of induction and mentor programs among the two career status groups within the context of adult learning. Mezirow (2012) explains that transformative learning "involves participation in constructive discourse to use the experience of others" (p.76) in the process of evaluating one's views and deciding upon a course of action using the insights one has gained. Second-career educators with 10 or more years' experience in a prior career may innately recognize this need for discourse with experienced teachers, through an induction program or a mentor, if they are to effectively transition into their new role as teachers. The difference in perceived importance of induction and mentor programs between first-career teachers and older, more-experienced career-changers becomes more profound in light of transformative learning theory.

For second-career teachers in this study, the value of being respected by school leaders was clear. Most of the interviewees, who expressed concern over not being treated as professionals, were second-career teachers. Similarly, during interviews, negative descriptions of authoritarian leadership styles and statements regarding the need for leadership support were made more often by career-changers than by first-career teachers.

Applications

The third research question guiding the present study asked, "How do urban high school leaders create the necessary conditions to foster retention of science teachers?" The results of this study, which are summarized in Table 5.8, illustrate that urban high school leaders have diverse opportunities for strengthening the commitment of their science teachers and promoting their retention. As interviewees in this study indicated, leaders need to create a positive school climate marked by school-wide discipline and a culture of relational trust among teachers and leaders.

Table 5.8

Summary of Key Findings: Conditions School Leaders Might Create to Promote Science Teacher Retention in Urban High Schools (Research Question 3)

Findings
Mentor and induction programs should be responsive to individual teachers' needs.
Alternative approaches to induction, such as collegial collaboration within a strong professional community, can be viable and efficacious alternatives to traditional mentoring and induction programs.
School leaders in urban high schools may promote the retention of their science teachers by: • Creating a safe and respectful school climate • Providing teachers with the freedom to make instructional decisions and opportunities to contribute to schoolwide decision-making • Embracing collaborative rather than authoritarian leadership practices • Communicating appreciation of teachers • Recognizing teachers' efforts and successes and providing constructive feedback • Fostering teachers' collaboration and collegiality • Valuing and respecting teachers' professional experiences, knowledge, and skills • Supporting new teachers regarding student behavior, classroom management, and interactions with students' parents and guardians • Promoting a culture of relational trust among teachers and leaders

Measures that safeguard teachers' individual identities are also important tools to create teacher commitment. Professional autonomy, a factor that supports a teacher's identity, emerged as an important factor in this study. Furthermore, it may be especially important for science teachers who are career-changers.

Teachers' high significance rating for *Autonomy* in this study may be best understood in the context of adult learning theory. Susan Mundry (2003) has described six assumptions of adult learning theory, one of which correlates well with this study's observed importance of professional autonomy, "Adults have a concept of themselves as responsible for their own decisions and will resist situations in which others impose their will" (p. 124). Interestingly, the results of this study also indicate that authoritarian management styles can erode teacher commitment, while a collaborative culture can promote teacher efficacy. Thus, this assumption about adult learning may also elucidate teachers' observed desire to participate in decision-making in their schools and teachers' negative views toward authoritarian leadership practices.

To build commitment of their science teachers, school leaders can strive to establish a school culture marked by appreciation and respect. The creation of this culture would involve valuing and acknowledging the contributions and efforts of teachers and recognizing their competence as professionals. Leaders can also foster a culture of respect and appreciation by soliciting and being attentive to teachers' input for decision-making. Furthermore, school leaders might prioritize time and resources for collegial collaboration as a means to increase the effectiveness of their new teachers and foster their commitment.

The low value assigned to *Mentor Programs* together with the high importance rating participants assigned to *Professional Community* in this study seem to point to a needed shift in

practice. In their extensive literature review regarding induction programs, including mentor programs, Long and her colleagues (2012) offered the following observation:

> What we found most problematic was whether there is a link between induction programs, including mentoring, and teacher retention. The effect of induction (including mentoring) programs is unclear in the light of multiple factors that influence teachers' staying or leaving. Complexities in induction (including mentoring) programs stem from differing ways they are conceptualized and the differing ways they are lived out. We are led to question about whether it is possible to structure or mandate induction programs that will "solve the problem" of beginning teacher attrition. (p. 21-22)

Long et al. (2012) proposed that a strong collaborative professional culture, responsive to the individual needs of teachers, might be a more effective approach to supporting new teachers than traditional mentor programs. The results of the present study appear to support that recommendation. If time and financial resources are not available to design an induction and mentoring program with diverse components based upon individual teachers' needs, then it might be more efficacious to use resources to foster collegial collaboration among science teachers.

As school leaders embrace their highly significant role of supporting their teachers, they might consider new teachers as an investment and commit to cultivating a highly effective team of educators. This study's results suggest that school leaders should prioritize support for teachers regarding student behavior, classroom management, and communication with parents. In addition, leaders might promote teachers' efficacy and commitment through open, positive interactions with teachers that include constructive feedback and affirmations of teachers' success.

The science teachers in this study expressed the importance of being recognized as professionals. Effective hiring practices are integral to achieving this goal. This study's results indicate that recruitment and hiring protocols should assess whether a potential employee is a suitable match for the organization. These practices would include an assessment of how well the teacher's vision aligns with that of the school and its leaders. Such recommendations agree with Kimball's (2011) description of the role of a school principal as *strategic talent manager*. In that model, principals recruit and hire teachers with the school vision in mind. In addition to using the school's vision as a guiding principle, principals support teachers' development and collaboration, provide them with ongoing feedback, and offer them leadership opportunities.

Assuming strategic hiring practices, the school leader would be able to allow teachers to apply their knowledge and expertise without what teachers perceive as micromanagement. Science teachers who are career-changes bring valuable expertise and experience to their school community. The reflections shared by the participants in this study suggest that school leaders should inquire about their specific needs, engage in open communication with them, and adjust supports, such as induction programs, to address their needs.

To promote their continued development, new teachers must feel safe in their setting. School leaders can establish a culture of relational trust to establish such an environment. Relational trust has been identified as a necessary foundation for organizational effectiveness and success (Finnegan, 2010; Lencioni, 2002). As educational leaders, administrators may create a culture of trust by modeling and promoting open, honest, and respectful communication within the school. Fostering collegial collaboration could augment these efforts as well.

The recommendations for school leaders derived from this study echo several of the guidelines provided to school leaders by Miles and Frank (2008). These recommendations, which were presented earlier in the review of literature, are revisited here:

A. Hiring and organizing staff to fit school needs in terms of expertise, philosophy, and schedule
B. Integrating significant resources for well-designed professional development that provides expert support to implement the school's core instructional design
C. Designing teacher work schedules to include blocks of collaborative planning time effectively used to improve classroom practice
D. Enacting systems that promote individual teacher growth through induction, leadership opportunities, professional development planning, evaluation, and compensation (Miles & Frank, 2008, p.24)

In particular, the results of this study highlight the importance of leaders' thoughtful hiring practices, commitment to professional community and collegial collaboration, and the development of support programs based upon teachers' needs.

Ultimately, the goal of teacher retention is to enhance student achievement. Therefore, student achievement trends need to be monitored in response to teacher retention efforts. The results of this study corroborate the findings of others (Alliance for Excellent Education, 2008; Goldhaber, et al., 2011; Johnson & Birkeland, 2003; McKinney et al., 2007) that teachers who are effective and successful in the classroom are likely to remain in their positions. Therefore, efforts to retain science teachers, if they are designed to promote teachers' success, can be expected to foster student success. Undoubtedly, the retention of effective teachers in urban area

schools, where difficult economic conditions bring educational challenges, holds promise for expanding opportunities for the children in these communities.

Limitations

This study's quantitative data were obtained using an online, self-report questionnaire. The researcher acknowledges the limitations of self-report data in studies of organizational behavior described in the literature (e.g., Podsakoff & Organ, 1986; Spector, 1994). Posakoff & Organ (1986), for instance, cite a validity problem associated with making correlations between two self-report variables such as, "the psychological states of respondents" (p.532) and "respondents' perceptions of an external environmental variable" (p.532). In the present study, however, correlations have not been made between factors assessed through the online survey. For example, correlations have not been assessed between teachers' intent to remain in their positions and their reports regarding the significance of retention or attrition factors.

Furthermore, some have suggested that the self-report methodology can be a valid measurement tool (Spector, 1994; Haeffel & Howard, 2010). Spector (1994), who describes an appropriate use of self-report data, provides an example of this view:

> Despite the weaknesses of the cross-sectional self-report methodology, this design can be quite useful in providing a picture of how people feel about and view their jobs. They also tell us about the intercorrelations among various feelings and perceptions. This can provide important insights and can be useful for deriving hypotheses about how people react to jobs. Additional methodologies will be needed to fully test these hypotheses, but cross-sectional questionnaires can provide a relatively easy first step in studying phenomena of interest. (p. 390)

Similarly, Haeffel & Howard (2010) challenge the generic criticism of self-report methodology, "Research suggests that self-report is well suited for assessing a number of theoretical constructs including cognitive products (e.g., attributions, plans, attitudes, and beliefs), emotions, and moods. Moreover, self-report may be a valid indicator of behavior" (p.186). In light of the contrasting views of self-report methodologies, the researcher recognizes the need for cautious review of this study's findings, but presents them with some confidence in their accurate descriptions of participants' views. Additionally, triangulation of data from open-response items and interviews has been used to reduce validity threats.

Notwithstanding self-report limitations, other elements of this study's design limit the generalizability of its findings. Primary among these elements is the nature of the purposeful sample that was used. The study population consisted of New England high school science teachers from urban area schools in which 50% or more of the student body was eligible for the Free and Reduced Price Lunch (FRPL) program. The decision to limit school selection to those that met an economic criterion was founded on literature that has identified teacher turnover problems in urban schools (Brown, 2003; Donaldson & Johnson, 2011; Marvel et al., 2007; Watlington et al., 2010), with poverty being a key factor (Hunt & Carroll, 2003; Ingersoll & May, 2012). In addition, the focus on science teachers derives from literature that has identified teacher turnover problems in certain subject areas, such as mathematics and science (Baker & Keller, 2010; Clotfelter et al., 2008; LaTurner, 2002; Ng & Peter, 2010). The decision to limit the study population to New England reflected both a desire to apply findings locally and to address the feasibility of the study. Because of the specific characteristics of the study population, the ability to extrapolate findings to other settings is limited.

The career status of this study's participants is another characteristic of the sample population that is pertinent to a discussion of generalizability. Nearly 52% of the survey participants and about 58% of interviewees were career-changers. Therefore, it is likely that the findings of this study might not apply to a population of predominantly first-career teachers.

In addition to the characteristics of the study population, the nature of the survey and interview data also affects generalizability. This study gathered information about teachers' perceptions of factors that influence their decisions to remain in a position or to leave. In Part 2 of the survey, teachers reflected on their experiences in their current school to rate the importance of various conditions with respect to their decisions to remain in their teaching positions. There is evidence that organizational characteristics in schools exert a cumulative effect on teacher retention (Ingersoll & May, 2012). It is possible, therefore, that the teachers' answers to retention factor survey items reflect, not just the single factor addressed by the item, but also the cumulative effect of many conditions they had experienced. The cumulative or emergent effects of multiple school conditions would limit the generalizability the findings to other settings that might have some, but not all, of the same conditions these teachers had experienced.

The same reasoning can be applied to the section of the online survey that examined attrition factors. For these items, teachers were asked to consider factors that might contribute to their decision to leave a teaching position. During interviews, some teachers explained that they actually had left other positions for one or more of these reasons. In such cases, their ratings of attrition factors were based on actual experiences. However, the responses of other teachers, who had never left a position or who were not considering leaving their present position, would

be conjecture. In light of these alternate scenarios for the participants, generalizability of the data from the attrition survey items is limited.

Other limits on the generalizability of this study's findings stem from the small number of interviews and the possibility that the interviewees may not be representative of the other science teachers in their schools. Thirty-one percent of teachers who did not volunteer for an interview did not identify the location (state) of their schools. While the reasons for non-disclosure of their schools' locations remain unknown, it is possible that there could be important, but unidentified, factors influencing the employment decisions of those science teachers.

Except for one face-to-face interview, all of the interviews for this study were conducted by individual telephone calls. Although this approach may have afforded interviewees a greater sense of confidentiality that may have fostered frank discussions of their work experiences, it also prohibited the researcher from making observations of conditions in the teachers' schools that might have been relevant to the study.

In summary, since research has shown that teacher turnover is affected by a variety of factors and conditions, the findings of this study cannot be broadly applied to the retention of teachers across disciplines, schools, and communities. Rather, the findings provide insight into the factors and conditions that may support and help to retain high school science teachers in schools of similar communities and socioeconomic conditions as those in this study.

Future Directions

Several questions raised by the present study could guide additional research. For instance, survey and interview results from this study indicate that first-career and second-career science teachers may differ in their evaluation of professional autonomy as a retention factor. Second-career science teachers rated *Autonomy* more important as a retention factor than did

first-career teachers but, with a probability of $p = .07$, the difference was not statistically significant. Additional research could examine the possible correlation between science teachers' career status and the value they assign to professional autonomy.

Induction programs, including mentor programs, offer a second area of future research. The findings of this study include a low importance rating for induction programs, and mentor programs, specifically. Furthermore, the findings suggest that many new science teachers in the population studied may not have had assigned mentors. The results also reveal that the some of the induction programs currently in use at these schools may be ineffective and unresponsive to the needs of the new teachers in those schools. Additional research could examine particular features of mentor and induction programs using teachers' career status as the independent variable. Such research might reveal the characteristics of effective induction and mentoring programs for each of these populations of educators.

A third area for future research involves school leadership. In the present study, several aspects of school leadership, which were addressed by separate survey items, were consolidated for statistical analysis. This practice enhanced the reliability of the study's findings. The results showed no significant difference in the importance rating assigned by first-career teachers and second-career teachers regarding *Leadership*. The question remains, however, whether first-career and second-career science teachers differ in their evaluation of specific leadership practices, such as leaders' management style or use of teacher input for decision-making. Therefore, a future study might address each aspect of leadership, and examine them separately. Such research would be useful to inform school leaders how to best promote the efficacy and retention of their first-career and second-career science teachers.

Because one of this study's objectives was to describe conditions that urban school leaders might create to improve the retention of their high school science teachers, the study focused on factors that school leaders can influence directly. However, the literature review for this study illustrates that pre-service programs offer additional possibilities for strengthening teacher retention. This study's findings that point to the need for differentiation in induction and mentor programs for first-career and second-career science teachers could apply to teacher education programs, as well. Pre-service programs may benefit from differentiated design; additional research could address this question.

Finally, while this study did not distinguish between science teachers who leave the profession and those who move to other schools, future research could examine the differences in perceptions of these groups of teachers. Such studies could investigate the school conditions, teacher preparation programs, or teacher characteristics that might contribute to specific attrition decisions among science teachers.

Summary

Teacher retention has been a longstanding concern in American education and the focus of many reports and empirical studies. In spite of the attention, unacceptable rates of teacher turnover have persisted, with some five-year turnover estimates as high as 50% for new teachers in some settings (Ingersoll & Smith, 2003). This study examined the issue of teacher retention for high school science teachers in urban area schools with challenging socioeconomic conditions.

To understand the phenomenon of teacher retention and attrition, relevant literature was reviewed, including studies that addressed a variety of variables found to influence retention and attrition. Based upon this literature review, several factors, which school leaders can influence,

were chosen for this investigation: *Leadership*, *Professional Community*, *Mentor Programs*, *Science Factor*s, *Induction Programs,* and *Autonomy*.

The findings of this study corroborate prior research regarding the importance of school leaders for teacher retention. Leaders' actions and the conditions they create broadly contribute to teachers' commitment to their setting. Through their management style and decision-making, leaders can promote teachers' sense of safety, honor teachers' individuality, convey their appreciation for teachers' work, demonstrate respect for teachers' expertise and efforts, foster collegial collaboration, and provide supports that enhance teachers' effectiveness.

Collegial collaboration can also support new teachers as they strive to become effective and successful in the classroom. In fact, a vibrant professional community may prove to be a more effective retention factor than an induction and mentoring program that has not been designed to meet the specific needs of the teachers it serves.

Science teachers who are career-changers were of particular interest in this study. In many ways, the needs and concerns of second-career teachers align with those of their first-career counterparts. However, this study has identified differences between these groups that deserve attention. Career-changers want to be recognized as professionals with valuable knowledge and skills. At the same time, however, these educators acknowledge their need for support from leaders and colleagues. Additionally, second-career teachers want supports, such as induction programs, that are sensitive and responsive to their needs.

Ultimately, the significance of science teacher retention lies in its effects on students, especially those in high-need school settings, such as urban schools with children of low economic means. As Johnson & Birkeland (2003) have described, teacher efficacy promotes teacher retention. Teachers who feel they are being effective in the growth and development of

their students are likely to stay in a position. Clearly, teacher efficacy is what schools must strive for, because effective teachers foster student achievement. For school leaders, facing a variety of competing demands for their time and attention, the time and effort required to improve teacher retention may be a wise expenditure because of the returns they promise to deliver.

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Appendix A

Online Dissertation Survey

High School Science Teacher Retention

CONSENT FORM FOR PARTICIPATION IN THIS RESEARCH STUDY

Please read the following information regarding this study. If you understand the information and agree to participate, please click on the link at the bottom to indicate your consent and go to the first screen of the survey.

RESEARCHER AND TITLE OF STUDY

My name is Rosemary C. Rak, and I am a student in the Educational Leadership Ph.D. program at Lesley University, Cambridge, MA. The title of my study is: Factors Affecting the Retention of First-career and Second-career Science Teachers in Urban High Schools.

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this research is to identify the conditions necessary to promote the retention of quality science teachers in urban high schools. It will also examine the similarities and differences among the factors promoting retention of first-career and second-career science educators. I anticipate a sample size of at least 300 participants.

WHAT DOES YOUR PARTICIPATION IN THIS STUDY INVOLVE?

You will be asked to complete a four-part on line survey (approximately 15 minutes duration). In the first section, you will provide basic information about your background, including the number of years in your current teaching position and your status as a first-career or second-career teacher. In parts two and three of the survey, you will rank the significance of various retention and attrition factors, and in part four you will provide some final background information.

The survey will also include open-ended items for you to describe retention factors not addressed, or inadequately addressed, in the survey.

Upon completing the survey, you may volunteer for a 30 - 45 minute interview. The interview process will be used to further explore your perceptions of conditions needed in schools to promote teacher retention. Volunteers for the interview will be asked to provide contact information (email and telephone number). Ten to twelve participants, equally representing first-career and second-career teachers, will be selected for interviews. Interviews will be conducted either in person or by telephone, and they will be digitally recorded.

WHAT ARE THE POSSIBLE RISKS OF PARTICIPATING IN THIS STUDY?

Participants' answers will be confidential. Neither individual nor school identities will be revealed in the study. Participation in this project is not expected to present any greater risk of your loss of personal privacy than you would encounter in everyday life when sending and/or receiving information over the Internet. While it is not possible to identify all risks in such research, all reasonable efforts have been undertaken to minimize any such potential risks by using the online survey tool, SurveyMonkey.

WHAT ARE THE POSSIBLE BENEFITS OF PARTICIPATING IN THIS STUDY?

The results of this study will inform efforts to retain quality science teachers in urban high schools. You may request a copy of the summary analysis when you submit your survey.

IF YOU CHOOSE TO PARTICIPATE IN THIS STUDY, WILL IT COST YOU ANYTHING?

There are no costs associated with participation.

WILL YOU RECEIVE ANY COMPENSATION FOR PARTICIPATING IN THIS STUDY?

You will not receive any direct benefits from your participation, but I hope that the information gained here may enhance science teacher retention in urban schools.

DO YOU HAVE TO TAKE PART IN THIS STUDY?

Your consent to participate in this research is voluntary, and there will be no consequences resulting from your refusal to participate.

CAN YOU WITHDRAW FROM THIS STUDY?

If you consent to participate in this study, you may stop your participation in the study at any time without consequence.

High School Science Teacher Retention

HOW WILL THE CONFIDENTIALITY OF YOUR RECORDS BE PROTECTED?
I seek to maintain the confidentiality of all data and records associated with your participation in this research. Further, any communication via the
Internet poses minimal risk of a breach of confidentiality.

Data will be secured at the home of the researcher. The researcher will have access to the survey results, and will report aggregated data and statistical analyses. Digital audio recordings will be made of interviews and these will be transcribed. Interviews will be assigned a code number to maintain confidentiality during transcription. No identifying information will be provided to transcribers. To promote accuracy, other individuals, in addition to the researcher will code the interviews. However, no identifying information will be released with the interview transcripts.

The results of this research will appear in the researcher's doctoral dissertation and may be published or reported to scientific bodies. Any such reports or publications will be reported in a group format. Thus, no individual identity will be determinable through demographic variables such as age or gender.

WHOM TO CONTACT IF YOU HAVE QUESTIONS ABOUT THIS STUDY
If you have any questions pertaining to this research you can contact the researcher: Rosemary C. Rak, rrak@lesley.edu (508-xxx-xxxx), or my senior advisor: Dr. Mary McMackin, mcmackin@lesley.edu to discuss them. You may also contact the IRB co-chairs for Lesley University: Robyn Cruz (rcruz@lesley.edu) or Terry Keeney (tkeeney@lesley.edu).

*** 1. Please indicate your consent to participate.**

- ○ Yes
- ○ No

You have decided not to participate. Thank you for your time.

Thank you for participating in this study. I am interested in learning about the factors that affect the retention of science teachers in urban high schools.

This survey will take 20 - 25 minutes of your time. I will maintain your responses securely and confidentially. They will be used solely for this study, which is being used for my doctoral dissertation and may also be used for subsequent publication. In all cases, your answers will remain completely anonymous.

You may decide at any point to exit the survey. If you have any questions or concerns, you may also contact me: rrak@lesley.edu or 508-XXX-XXXX. Thank you for your participation.

To progress through this survey, please use the following navigation buttons:

Click the Next button to continue to the next page.
Click the Exit the Survey Early button if you need to exit the survey.
Click the Submit button to submit your survey.

*** 2. What is your current year of teaching in this school? (Please do not include time you may have been employed as a substitute teacher.)**

○ 1st year ○ 2nd year ○ 3rd year ○ 4th year ○ 5th year ○ 6th year ○ 7th year or higher

High School Science Teacher Retention

***3. At this time, how long do you see yourself staying in your current teaching position?**

○ less than 1 year ○ 1 – 2 years ○ 3 – 5 years ○ more than 5 years

*** 4. Did you teach in one or more other schools or districts prior to your current position?**

○ Yes

○ No

*** 5. Is teaching your first career, or have you worked in a prior career (referred to in this study as a second-career teacher)?**

NOTE: For the purposes of this study, "career" is defined as paid employment for which you had completed some post-secondary education.

○ First-career teacher

○ Second-career teacher

***6. As a second-career teacher, how many years did you spend in your prior career(s)?**

○ 1-3years ○ 4 - 6 years ○ 7-9 years ○ 10-15 years ○ more than 15 years

Please name your previous career(s)

***7. Prior to starting your first career, had you ever considered teaching as a career?**

○ Yes

○ No

***8. Prior to teaching, did you have any family members or close friends who were employed as teachers?**

○ Yes

○ No

For the next 12 items, please indicate how significant each of the following factors has been in affecting your decision to remain in your current teaching position.
If an item has not been part of your experience, select N/A (not applicable).

Please use the space provided for comments to explain a 'not applicable' response or to provide additional information or feedback

High School Science Teacher Retention

Note: 'immediate supervisor[1] refers to the administrator who is mainly responsible for your performance evaluations, and 'colleagues' refers to the other science teachers in your school.

***9. Feeling valued and respected by my school principal**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

*** 10. Feeling that my immediate supervisor wants me to succeed**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***11. Having opportunities to collaborate with colleagues on planning lessons (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***12. Having adequate supplies and attention to laboratory safety**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***13. Having opportunities to collaborate with colleagues about lab investigations**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

High School Science Teacher Retention

***14. Having sufficient time in the teaching schedule for lab investigations (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

*** 15. Having a sense of camaraderie within my department (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

*** 16. Feeling valued as a professional by my immediate supervisor (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***17. Feeling that my colleagues want me to succeed (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***18. Having opportunities to meet regularly with my mentor (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

High School Science Teacher Retention

*** 19. Having a safe school climate regarding school-wide student behavior and discipline (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

*** 20. Having the opportunity to contribute to school decision-making (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

For the next 11 items, please indicate how significant each of the following factors has been in affecting your decision to remain in your current teaching position.

If an item has not been part of your experience, select N/A (not applicable).

Please use the space provided for comments to explain a 'not applicable' response or to provide additional information or feedback.

Note: 'immediate supervisor' refers to the administrator who is mainly responsible for your performance evaluations, and 'colleagues' refers to the other science teachers in your school.

***21. Receiving consistent and supportive feedback from school leadership (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***22. Receiving an orientation or induction program during my first year at this school (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

High School Science Teacher Retention

***23. Having a mentor who teaches the same subject as I do**
(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***24. Having opportunities to collaborate with colleagues about student achievement**
(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***25. Feeling that my mentor wants me to succeed**
(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***26. Having a mentor who visits my classes to help me improve my practice (Select N/A if this has not been part of your experience.)**

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***27. Having opportunities to collaborate with colleagues regarding student discipline**
(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

High School Science Teacher Retention

***28. Feeling respected by my colleagues**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***29. Having the freedom to choose instructional approaches and assessments for my students**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***30. Having ready access to sufficient laboratory equipment and supplies**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

***31. Having a school principal who values science instruction**

(Select N/A if this has not been part of your experience.)

Not Significant						Very Significant
1	2	3	4	5	6	7
○	○	○	○	○	○	○

Comment

For the next 10 items, please indicate how significant each factor would be in contributing to your decision to leave your teaching position, either to teach in a different school or to leave the profession entirely.

Please use the Comment space for additional information or feedback.

Note: 'immediate supervisor[1] refers to the administrator who is mainly responsible for your performance evaluations, and 'colleagues' refers to the other science teachers in your school.

High School Science Teacher Retention

***32. Not feeling respected by my school principal**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***33. Feeling unsure about my immediate supervisor's views regarding my performance**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***34. Lacking opportunities to collaborate with colleagues in planning lessons**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***35. Feeling that my immediate supervisor does not value my efforts**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***36. Feeling there may be negative consequences if I share my views on school issues or try new instructional approaches**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***37. Feeling isolated from other science teachers**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

High School Science Teacher Retention

***38. Not having an assigned mentor**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***39. Having Insufficient time in the teaching schedule for lab investigations**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***40. Lacking opportunities to collaborate with colleagues about lab investigations**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***41. Being part of a department/school where laboratory safety is not a priority**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

For the next 13 items, please indicate how significant each factor would be in contributing to your decision to leave your teaching position, either to teach in a different school or to leave the profession entirely.

Please use the Comment space for additional information or feedback.

Note: 'immediate supervisor[1] refers to the administrator who is mainly responsible for your performance evaluations, and 'colleagues' refers to the other science teachers in your school.

***42. Feeling unsafe at school due to student behavior or discipline issues**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

High School Science Teacher Retention

***43. Having a school principal who does not value teacher input for decision-making**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***44. Experiencing inconsistencies in how school leaders enforce school rules**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***45. Not receiving an orientation or induction program during my first year**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***46. Having a mentor who teaches in a different academic department**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***47. Lacking opportunities to collaborate with colleagues regarding student achievement**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***48. Having a mentor who seldom meets with me and is minimally invested in helping me succeed**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

High School Science Teacher Retention

***49. Having a mentor who never visits my classes to help me improve my practice**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***50. Lacking opportunities to collaborate with other teachers in addressing student discipline**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***51. Having colleagues who do not welcome me or who do not treat me respectfully**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***52. Having limited freedom regarding my choices of instructional approaches and methods of student assessment**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***53. Lacking laboratory equipment and supplies or having insufficient access to them**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O

Comment

***54. Having a school principal who does not value or appreciate science**

Not Significant						Very Significant
1	2	3	4	5	6	7
O	O	O	O	O	O	O Comment

High School Science Teacher Retention

55. Please describe any factors or conditions not addressed in this survey that have been important influences on your decision to stay in your current teaching position.

56. Please identify any factors or conditions not addressed in this survey that would contribute significantly to your decision to leave a teaching position.

***57. What is your school's location?**

City/Town:

State:

***58. What is your gender?**

- Female
- Male

*** 59. Which category below includes your age?**

- Less than 30
- 30-39
- 40-49
- 50 or older

***60. Do you currently have an active teaching license for the subject(s) you are teaching?**

- Yes, for all subjects
- Yes, for some subjects.
- No.

Comments

High School Science Teacher Retention

***61. For what science subject(s) do you hold an active teaching license**

- O Biology
- O Chemistry
- O Earth Science
- O Physics
- O Other - Please specify in Comment space Comment

***62. What science subjects are you currently teaching?**

- O Biology
- O Chemistry
- O Earth Science
- O Physics
- O Other (please specify)

*** 63. Prior to your current teaching position, how would you rate your commitment to teaching in an urban high school?**

- O Strong
- O Neutral
- O Weak
- O Other (please specify)

***64. How would you rate your current commitment to teaching in an urban high school?**

- O Strong
- O Neutral
- O Weak
- O Other (please specify)

High School Science Teacher Retention

65. If you would be willing to participate in a 30-45 minute interview as a follow-up to this survey, please provide your contact information below.

Depending on your location, the interview may be conducted in person or by telephone. I will maintain your responses securely and confidentially. Interviews will be digitally recorded and later transcribed.

Name:

School:

Email:

Phone Number:

66. If you would like a copy of the study's results, please provide your email address below

Email Address:

Concluding Page

I appreciate your time and thoughtful answers to this survey. Thank you.

Appendix B
Interview Instrument

Please provide the following information:

a) The number of years you have been in your current teaching position

b) Are you a first-career or second-career teacher?

c) Your gender

Interview questions:

1. Please describe your reasons for choosing a career in teaching and your thoughts about teaching in an urban school.

   Additional question for teachers who have taught in other schools prior to their current position:

   Was your previous teaching position in the same school district or a different one? Please explain why you left your prior teaching position(s).

2. In the book, *Rethinking Retention in Good Times and Bad*, Richard Finnegan describes the things that employees most want from their employers as "glues."

   If you feel a strong commitment to your present school, can you describe the "glues," or unique aspects of your experience, that contribute to your desire to stay at this school?

   If your commitment to your current school is weak, please describe the conditions or experiences you believe would strengthen your commitment.

3. Considering factors that are under the control of school leaders, what would be your main reasons for deciding to leave a position within your first few years?

4. As a first-career (or second-career) teacher, what conditions do you think urban high school leaders should create to promote the retention of their first career (or second-career) science teachers?

5. Do you feel we have covered the factors you wished to discuss? Are there any other topics you would like to discuss?

Appendix C

Sample Letters of Invitation

Dear High School Principal/Science Supervisor:

I am a recently retired high school science teacher and former science supervisor from the Taunton High School in Taunton, Massachusetts. Currently, I am a doctoral student in in the Educational Leadership Ph.D. program at Lesley University in Cambridge, MA. I am writing to ask your support of my doctoral dissertation study of science teacher retention in urban high schools in New England. Part of my study involves **science teachers** completing a voluntary **15 minute online survey**. The survey may be completed at any time, at home or at school.

Responses from a large number of science educators in New England will greatly enhance the study. *Confidentiality is guaranteed* for participants and their schools. All participants will have the opportunity to request a copy of the study's results.

Science supervisors,

Kindly forward this email to the science teachers in your school.

Please reply to this email with the number of teachers in your department at the time you forward the email to your staff. I will need this information to determine my population size and percent participation.

I sincerely hope that the science teachers in your school will participate! The attached letter to science teachers provides additional information.

If you have any questions at this time, you may e-mail me, rrak@lesley.edu, or contact my senior advisor, Dr. Mary McMackin, mcmackin@lesley.edu.

Thank you for your assistance and support of my research.

Sincerely,
Rosemary C. Rak
Science Educator and
Doctoral Student
Lesley University, Cambridge, MA

Science teachers,

Please see the attached letter for more information.

***The link for the online survey is*:**

https://www.surveymonkey.com/s/RBRZC77

Thank you for your participation!

Sincerely,
Rosemary C. Rak
Science Educator and
Doctoral Student
Lesley University, Cambridge, MA

Letter of Invitation to Science Teachers

Dear science educator:

I am writing to ask your assistance with my doctoral research. For more than 32 years, I was a Taunton High School science teacher in Massachusetts. For 20 of those years, I also served as the science supervisor for my school.

My experiences as a science educator and leader led to my interest in the field of science teacher retention in urban high schools. Now, as a student in the Educational Leadership Ph.D. program at Lesley University in Cambridge, MA, I have chosen science teacher retention as the focus for my dissertation study. The title of my study is, *Factors Affecting the Retention of First-career and Second-career Science Teachers in Urban High Schools*.

I am conducting a survey of science teachers in urban high schools in New England, and I hope that you will choose to participate. The survey will take approximately 15 minutes and can be accessed through the following link: https://www.surveymonkey.com/s/RBRZC77 This link will be available for a two-week period. Confidentiality is guaranteed for participants and their schools.

Participation in this study is voluntary. However, the responses from a large number of science educators in New England will greatly enhance the study. As a participant, you will have the opportunity to request a copy of the study's results.

I know firsthand how important your time is, so I am most grateful for your participation. The information gathered through this research may help high schools retain their quality science instructors and thereby enhance science education for students in urban high schools.

If you have any questions, you may e-mail me, rrak@lesley.edu, or call 508-xxx-xxxx. You may also contact my senior advisor at Lesley University, Dr. Mary McMackin, mcmackin@lesley.edu. Thank you.

Sincerely,

Rosemary C. Rak

Science Educator and
Doctoral Student
Lesley University
Cambridge, MA

Appendix D

E-mail Survey Invitation to Science Teachers

Dear High School Science Teacher,

I have been a high school science educator for over 32 years at the Taunton High School in Taunton, MA. Last June, I retired from that position, and I am working on my doctoral dissertation on urban high school science teacher retention. I hope to learn ways that we can support new science teachers in urban high school settings.

Your input to my study is important. Please consider taking my online survey which will require about 15 minutes of your time. Confidentiality will be maintained for all participants. Please contact me if you have any questions: rrak@lesley.edu

The survey is currently open and you may access it at any time at:

https://www.surveymonkey.com/s/TYQWXS2

Because I know the many demands on your time, I greatly appreciate your contribution to my study. Thank you for your support! Best wishes for a great school year!

Sincerely,

Rosemary Rak
Science Educator and
Doctoral Student, Lesley University
Cambridge, MA

Appendix E

Urban High School Science Teacher Retention Follow-up Interview Consent Form

You have offered to participate in a research study conducted by Rosemary Rak, doctoral student at Lesley University in Cambridge, MA.

The purpose of the study is to identify factors that contribute to the retention of high school science teachers in urban settings. The results of this study will be included in Rosemary Rak's doctoral dissertation and may also appear in subsequent journal publications.

You were selected as a possible interviewee in this study because you volunteered during the survey portion of the study. You should read the information below, and ask questions about anything you do not understand, before deciding whether or not to participate.

• This interview is voluntary. You have the right not to answer any question, and to stop the interview at any time or for any reason. I expect that the interview will take about 30 45 minutes.

• You will not be compensated for this interview.

• Unless you give me permission to use the city/state location of your school and / or quote you (without personal identification) in any publications that may result from this research, the information you provide will be confidential. I will assign codes to interview recordings for tracking purposes.

• The interview will be conducted through a conference call service or during a face-to-face meeting in an agreed-upon location, if travel permits.

• I would like to digitally record this interview so that I can have it transcribed and use it for reference while proceeding with this study. I will not record this interview without your permission. If you do grant permission for this conversation to be recorded, you have the right to revoke recording permission and/or end the interview at any time.

I anticipate completing this project over the next several months to 1 year. The recordings will be destroyed within 6 months after the completion of the project.

1. Indicate your consent below.
(Please check all that apply)

___ I give permission for this interview to be recorded by conference call.

___ I give permission for a digital audio recording to be made of a face-to-face interview.

___ I give permission for direct quotes from this interview to be included in publications resulting from this study if my name is NOT published (I remain anonymous).

___ I give permission for the city and state of my school to be used with a direct quote from this interview to be included in publications resulting from this study (I remain anonymous and the name of my school is not identified).

___ I have decided NOT to participate in an interview.

2. Please indicate four dates and times that would be suitable for your interview from November 12th through December 9th. The dates may be weekdays or weekends. (Example: November 12th between 2 and 5 PM)

I will contact you by email to finalize our interview plans. Thank you!

3. If there is interest, I will form a focus group of interviewees to review my summary of the interview results.

____I do NOT wish to participate in a focus group to review the interview results for this study.

____I do wish to participate in a focus group (via email and conference call) to review the interview results for this study.

4. In the space below, please provide your name and email address so I may contact you for an interview. Thank you.

Appendix F

Survey Item Validity

Table F1

Grounding of Survey Items in Teacher Retention Literature

PART 2 SURVEY ITEM	REFERENCE	FOUNDATION IN RELATED LITERATURE
9. Feeling valued and respected by my school principal	Finnegan, 2010	"My supervisor sets aside time just for me and believes my opinions are important" (p. 106).
	Certo & Fox 2002	"Their comments evidenced that they defined school-level administration support as policies or practices present that supported teacher work and created an environment that treated teachers as professionals" (p. 7).
10. Feeling valued and respected by my school principal	Finnegan, 2010	"My supervisor sets aside time just for me and believes my opinions are important" (p. 106).
	Certo & Fox 2002	"Their comments evidenced that they defined school-level administration support as policies or practices present that supported teacher work and created an environment that treated teachers as professionals" (p. 7).
11. Feeling that my immediate supervisor_wants me to succeed	Finnegan, 2010	"My supervisor knows me…and keeps coaching me on ways to do better and learn more" (p. 107).
12. Having opportunities to collaborate with colleagues on planning lessons	Finnegan, 2010	"Connect each new employee to at least one designated peer for support" (p. 106).
	Certo & Fox, 2002	Retention factor: "… time given for teachers and staff to collaborate on lessons and units, share instructional materials and strategies, and to discuss student work was given as a reason that teachers continued working in their school divisions" (p.6).

13. Having adequate supplies and attention to laboratory safety	Certo & Fox, 2002	"Instructional materials and functional, current technology were described by focus group teachers as inadequate, and as a reason for teachers leaving…" (p. 11). "Some teachers … felt that building level administration did not provide the resources and supplies needed by teachers" (p.13).
14. Having opportunities to collaborate with colleagues about lab investigations	Certo & Fox, 2002	Retention factor: "… time given for teachers and staff to collaborate on lessons and units, share instructional materials and strategies, and to discuss student work was given as a reason that teachers continued working in their school divisions" (p.6).
15. Having sufficient time in the teaching schedule for lab investigations		Researcher's experience
16. Having a sense of camaraderie within my department	Finnegan, 2010	"Use social functions to build peer relationships by observing who connects easily and who seems left out so you can coach later to bring teammates together" (p. 106).
	Certo & Fox 2002	"…some teachers did feel that they remained in their divisions because of their colleagues, many feeling that their school was like a "family" **(**p. 6). Regarding a teacher who did not return to teaching after a nonrenewal: "Ranya, who felt no such camaraderie and had minimal support, saw herself as ineffective"
17. Feeling valued as a professional by my immediate supervisor	Finnegan, 2010	"My supervisor sets aside time just for me and believes my opinions are important" (p106).
	Certo & Fox 2002	"Their comments evidenced that they defined school-level administration support as policies or practices present that supported teacher work and created an environment that treated teachers as professionals" (p. 7).

18. Feeling that my colleagues want me to succeed	Lencioni, 2002	"In the context of building a team, trust is the confidence among team members that their peers' intentions are good, and that there is no reason to be protective or careful around the group" (p. 195).
19. Having opportunities to meet regularly with my mentor	Finnegan, 2010	"Connect each new employee to at least one designated peer for support" (p. 106).
20. Having a safe school climate regarding school-wide student behavior and discipline	Johnson & Birkeland, 2003	Regarding teachers who voluntarily moved to new schools or districts within three years: "They left schools where student disrespect and disruption were taken for granted as inevitable and moved to schools that had well-established norms of respect, effective discipline systems, and deliberate approaches to parental involvement" (p.598).
21. Having the opportunity to contribute to school decision-making	Certo & Fox 2002	"Teachers wanted more autonomy with regard to decisions made about school policy and student learning" (p.13).
22. Receiving consistent and supportive feedback by school leadership	Certo & Fox, 2002	"Teachers also felt that colleagues left because they felt their principals were not visible, and did not care what occurred in their classrooms" (p.12).
21. Receiving an orientation or induction program during my first year at this school	Alliance for Excellent Education, 2008	Regarding methods to promote teacher retention in hard-to-staff schools: "Comprehensive induction, a program that includes varying degrees of training, support, and assessment during a teacher's first years on the job, proves most effective" (p.5).
23. Having a mentor that teaches the same subject as I do	David, 2003	Suggested considerations for principals: "Choose mentors who teach in the same grade range (i.e., primary or intermediate) or subject area as that of their proteges" (p.152).

24. Having opportunities to collaborate with colleagues about student achievement	Certo & Fox, 2002	Retention factor: "… time given for teachers and staff to collaborate on lessons and units, share instructional materials and strategies, and to discuss student work was given as a reason that teachers continued working in their school divisions"(p.6).
25. Feeling that my mentor wants me to succeed	Lencioni, 2002	"In the context of building a team, trust is the confidence among team members that their peers' intentions are good, and that there is no reason to be protective or careful around the group" (p. 195).
26. Having a mentor who visits my classes to help me improve my practice	Alliance for Excellent Education, 2008	"Comprehensive induction combines high-quality mentoring with release time for both new teachers and mentor teachers to allow them time to usefully engage with one another…" (p.5)
27. Having opportunities to collaborate with colleagues regarding student discipline	Certo & Fox, 2002	Retention factor: "… time given for teachers and staff to collaborate on lessons and units, share instructional materials and strategies, and to discuss student work was given as a reason that teachers continued working in their school divisions"(p.6).
28. Feeling respected by my colleagues	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585). Regarding a teacher who left and had asked colleagues for help: "But help was not forthcoming, even when she asked several colleagues for assistance" (p. 596).
29. Having the freedom to choose instructional approaches and assessments for my students	Certo & Fox, 2002	"Teachers wanted more autonomy with regard to decisions made about school policy and student learning" (p.13).
	Johnson & Birkeland, 2003	"By his 3rd year, … things at the school began to unravel. The principal suddenly abandoned a plan for improving the school that he had encouraged the teachers to develop. Tensions grew in relation to issues of curriculum and autonomy, leading 11 of 16 staff members to leave at the end of Derek's 3rd year" (p. 596).

30. Having ready access to sufficient laboratory equipment and supplies	Certo & Fox, 2002	"Instructional materials and functional, current technology were described by focus group teachers as inadequate, and as a reason for teachers leaving…" (p. 11). "Some teachers … felt that building level administration did not provide the resources and supplies needed by teachers" (p.13).
31. Having a school principal who values science instruction	Certo & Fox, 2002	"Teachers wanted principals to listen to their needs" (p. 13).

PART 3 SURVEY ITEM	REFERENCE	FOUNDATION IN RELATED LITERATURE
32. Not feeling respected by my school principal	Johnson & Birkeland 2003	Dominant characteristics of schools Movers chose: "…administrators who understood the challenge of being a new teacher, were fair and encouraging, and created structures of support and interaction among the school's teachers" (p. 599). From Settled Stayers: "Each thought she had the respect of her principal" (p. 650).
33. Feeling unsure about my immediate supervisor's views regarding my performance	Johnson & Birkeland, 2003	Dominant characteristics of schools Movers chose: "…administrators who understood the challenge of being a new teacher, were fair and encouraging, and created structures of support and interaction among the school's teachers" (p. 599). Reported by one Mover: Regarding meetings with her new supervisor "Regular meetings with her new supervisor were important" (p.601).
34. Lacking opportunities to collaborate with colleagues in planning lessons	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585).

35. Feeling that my immediate supervisor does not value my efforts	Finnegan, 2010	"My supervisor sets aside time just for me and believes my opinions are important" (Pg. 106).
	Certo & Fox, 2002	"Their comments evidenced that they defined school-level administration support as policies or practices present that supported teacher work and created an environment that treated teachers as professionals" (p. 7).
36. Feeling there may be negative consequences if I share my views on school issues or try new instructional approaches	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585). Reported by a mover regarding new supervisor: "…And I never felt like I was getting off track. I always felt like I could be very open with him" (p.601).
37. Feeling isolated from other science teachers	Johnson & Birkeland, 2003	Regarding teachers who voluntarily moved to new schools or districts within three years: "Their accounts revealed that they had ‘, and transferred to schools that offered organized support for new teachers and schoolwide collegial interaction" (p.598).
38. Not having an assigned mentor	Finnegan, 2010	"Connect each new employee to at least one designated peer for support" (p. 106).
39. Having insufficient time in the teaching schedule for lab investigations		Researcher's experience
40. Lacking opportunities to collaborate with colleagues about lab investigations	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585).
41. Being part of a department/school where laboratory safety is not a priority	Johnson & Birkeland, 2003	Reported by "Settled Stayers": "safe, orderly environments" (p. 603).

42. Feeling unsafe at school due to student behavior or discipline issues	Johnson & Birkeland, 2003	Regarding teachers who voluntarily moved to new schools or districts within three years: "They left schools where student disrespect and disruption were taken for granted as inevitable and moved to schools that had well-established norms of respect, effective discipline systems, and deliberate approaches to parental involvement" (p. 598). Reported by Settled Stayers: "safe, orderly environments" (p. 603).
43. Having a school principal who does not value teacher input for decision-making	Johnson & Birkeland, 2003	One teacher who left within 3 years described her principal's management style: "…edict by voicemail (with) no invitation at all for any discussion" (p. 594). Input from Settled Stayers: "These school leaders arranged schedules that accommodated team planning and structured explicit opportunities for collegial interaction" (p.605).
44. Experiencing inconsistencies in how school leaders enforce school rules	Johnson & Birkeland, 2003	"By his 3rd year, … things at the school began to unravel. The principal suddenly abandoned a plan for improving the school that he had encouraged the teachers to develop. Tensions grew in relation to issues of curriculum and autonomy, leading 11 of 16 staff members to leave at the end of Derek's 3rd year" (p. 596).
45. Not receiving an orientation or induction program during my first year	Alliance for Excellent Education, 2008	Regarding methods to promote teacher retention in hard-to-staff schools: "Comprehensive induction, a program that includes varying degrees of training, support, and assessment during a teacher's first years on the job, proves most effective" (p.5).
46. Having a mentor who teaches in a different academic department	Johnson & Birkeland, 2003	Mentor assignments among their participants were often inappropriate. That is, "different subjects, grades, or even schools" (p.608).

47. Lacking opportunities to collaborate with colleagues regarding student achievement	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585).
48. Having a mentor who seldom meets with me and is minimally invested in helping me succeed	Johnson & Birkeland, 2003	Regarding mentors: "personalities seldom clicked" in their study (p. 608).
49. Having a mentor who never visits my classes to help me improve my practice	Kardos, Johnson, Peske, Kauffman, & Liu, 2001	Regarding mentors: "Some reported meeting with their assigned mentors only once at the beginning of the year" (p.265-266).
50. Lacking opportunities to collaborate with other teachers in addressing student discipline	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585)
51. Having colleagues who do not welcome me or who do not treat me respectfully	Johnson & Birkeland, 2003	"In weak professional communities, teachers are left to fend for themselves and find themselves competing rather than collaborating with colleagues" (p. 585). Regarding a teacher who left and had asked colleagues for help: "But help was not forthcoming, even when she asked several colleagues for assistance" (p. 596).
52. Having limited freedom regarding my choices of instructional approaches and methods of student assessment	Johnson & Birkeland 2003	One teacher who left within 3 years described her principal's management style: "…edict by voicemail (with) no invitation at all for any discussion" (p. 594).

53. Lacking laboratory equipment and supplies or having insufficient access to them	Johnson & Birkeland, 2003	Regarding teachers who left within 3 years: "Working conditions loomed large, as teachers longed for the support and resources that would enable them to feel successful." One teacher in this study said, "…Nothing is set up for anything, labwise, nothing – no textbooks for a month and a half" (p.595).
54. Having a school principal who does not value or appreciate science	Johnson & Birkeland, 2003	"A heavy teaching load, an unsupportive principal, or a broken copy machine can interfere with good teaching and make it hard for teachers to achieve the intrinsic rewards they seek" (p.584).

Appendix G
Characteristics of Survey Participants

Table G1

Demographic Characteristics of Survey Participants

Characteristic		Number	Total	Percentage
Gender	Female	68	113	60.2%
	Male	45		39.8%
Age	Less than 30	24	113	21.2%
	30 – 39	32		28.3%
	40 – 49	18		15.9%
	50 or older	39		34.5%

Table G2

Employment Characteristics of Participants

Characteristic		Number	Total	Percentage
Years in Current Position	1st	13	136	9.6%
	2nd	12		8.8%
	3rd	10		7.4%
	4th	6		4.4%
	5th	12		8.8%
	6th	14		10.3%
	7th or greater	69		50.7%
Intended Time to Remain in Current Position	Less than 1 year	10	136	7.4%
	1-2 years	24		17.6%
	3-5 years	30		22.1%
	More than 5 years	72		52.9%
Previous Employment in Another School or District	Yes	66	136	48.5%
	No	70		51.5%

Appendix H

Comparisons of Retention and Attrition Factors among Age Groups

Table H1

Mean Multi-Item Retention Factor Scores by Participants' Age Groups

Retention Factor	Age Group	N	Mean (SD)	Range of Possible Scores
Leadership	Less than 30	24	36.71 (8.05)	7 - 49
	30-39	32	33.53 (9.34)	
	40-49	18	39.89 (6.75)	
	50 or older	39	34.95 (12.42)	
	Total	113	35.71 (10.06)	
Professional Community	Less than 30	24	33.46 (8.95)	7 - 49
	30-39	32	31.66 (8.87)	
	40-49	18	38.06 (9.30)	
	50 or older	39	34.72 (11.38)	
	Total	113	34.12 (9.99)	
Mentor Program	Less than 30	24	12.00 (6.62)	4 - 28
	30-39	32	8.22 (7.89)	
	40-49	18	9.06 (10.80)	
	50 or older	39	8.82 (10.36)	
	Total	113	9.36 (9.07)	
Science Factors	Less than 30	24	11.38 (4.61)	3 - 21
	30-39	32	13.97 (4.87)	
	40-49	18	16.50 (4.09)	
	50 or older	39	13.36 (6.64)	
	Total	113	13.62 (5.56)	

Note. M is the mean of perceived significance scores for each category of retention and attrition factor.

Table H1 (continued)

Mean Multi-Item Attrition Factor Scores by Participants' Age Groups

Attrition Factors	Age Group	N	Mean (SD)	Range of Possible Scores
Leadership	Less than 30	24	42.38 (8.25)	8 - 56
	30-39	32	38.69 (9.78)	
	40-49	18	44.67 (7.88)	
	50 or older	39	40.85 (11.28)	
	Total	113	41.17 (9.86)	
Professional Community	Less than 30	24	25.67 (8.46)	6 - 42
	30-39	32	22.31 (7.56)	
	40-49	18	28.89 (8.30)	
	50 or older	39	26.03 (8.88)	
	Total	113	25.35 (8.52)	
Mentor Program	Less than 30	24	11.62 (5.38)	4 - 28
	30-39	32	8.84 (5.86)	
	40-49	18	12.89 (7.48)	
	50 or older	39	12.08 (6.79)	
	Total	113	11.20 (6.48)	
Science Factors	Less than 30	24	11.54 (3.43)	3 - 21
	30-39	32	11.59 (4.94)	
	40-49	18	15.39 (3.87)	
	50 or older	39	13.13 (4.40)	
	Total	113	12.72 (4.46)	

Note. M is the mean of perceived significance scores for each category of retention and attrition factor.

Table H2
Mean Single-Item Retention and Attrition Factor Scores by Participants' Age Groups

	Age Group	N	Mean (SD)
Retention Factors			
	Less than 30	20	2.95 (1.90)
	30-39	28	3.14 (1.20)
Induction Program	40-49	14	4.14 (2.18)
	50 or older	26	4.35 (2.28)
	Total	88	3.61 (2.15)
	Less than 30	23	5.48 (1.68)
	30-39	32	5.97 (1.36)
Autonomy	40-49	18	6.72 (.58)
	50 or older	39	5.92 (1.42)
	Total	112	5.97 (1.40)
Attrition Factors			
	Less than 30	24	2.62 (1.76)
	30-39	32	1.88 (1.41)
No Induction	40-49	18	3.2222
	50 or older	39	2.85 (2.05)
	Total	113	2.58 (1.87)
	Less than 30	24	5.54 (1.53)
	30-39	32	5.16 (1.72)
Lack Autonomy	40-49	18	6.55 (.86)
	50 or older	39	5.85 (1.29)
	Total	113	5.70 (1.48)

Note. M is the mean of perceived significance scores for each category of retention and attrition factor that range from 1 to 7.

Table H3

Test of Homogeneity of Variances for Age Groups (<30, 30-39,40- 49, and ≥50 years)

	LT for EV	df1	df2	Sig.
Retention Factors				
Leadership	3.993	3	109	.010
*Professional Community**	1.891	3	109	.135
Mentor	4.764	3	109	.004
Science Factors	4.608	3	109	.004
Attrition Factors				
*Leadership**	.526	3	109	.665
*Professional Community**	.063	3	109	.979
*Mentor**	.752	3	109	.523
*Science Factors**	1.353	3	109	.261
Single Item Retention Factors				
*Induction Program**	.769	3	84	.514
Autonomy	4.497	3	108	.005
Single Item Attrition Factors				
No Induction	2.676	3	109	.051
Lack Autonomy	3.645	3	109	.015

Note. LT for EV is Levene's Test for Equality of Variance. *Homogeneity of variances assumed.

Table H4
ANOVA for Retention and Attrition Factors between Age Groups

Retention Factors		Sum of Squares	df	Mean Square	F	Sig.
Leadership	Between Groups	512.761	3	170.920	1.720	.167
	Within Groups	10832.602	109	99.382		
	Total	11345.363	112			
*Professional Community**	Between Groups	497.485	3	165.828	1.694	.173
	Within Groups	10672.019	109	97.908		
	Total	11169.504	112			
Mentor Program	Between Groups	221.967	3	73.989	.896	.446
	Within Groups	8996.157	109	82.534		
	Total	9218.124	112			
Science Factors	Between Groups	276.799	3	92.266	3.161	.028
	Within Groups	3182.068	109	29.193		
	Total	3458.867	112			
*Induction Program**	Between Groups	32.886	3	10.962	2.502	.065
	Within Groups	367.977	84	4.381		
	Total	400.864	87			
Autonomy	Between Groups	15.831	3	5.277	2.834	.042
	Within Groups	201.088	108	1.862		
	Total	216.920	111			
Attrition Factors *Leadership**	Between Groups	456.228	3	152.076	1.590	.196
	Within Groups	10423.577	109	95.629		
	Total	10879.805	112			
*Professional Community**	Between Groups	540.880	3	180.293	2.590	.057
	Within Groups	7586.960	109	69.605		
	Total	8127.841	112			
*Mentor Program**	Between Groups	263.326	3	87.775	2.159	.097
	Within Groups	4432.391	109	40.664		
	Total	4695.717	112			
*Science Factors**	Between Groups	208.624	3	69.541	3.759	.013
	Within Groups	2016.314	109	18.498		
	Total	2224.938	112			
No Induction Program	Between Groups	26.138	3	8.713	2.600	.056
	Within Groups	365.313	109	3.351		
	Total	391.451	112			
Lack of Autonomy	Between Groups	24.071	3	8.024	3.945	.010
	Within Groups	221.698	109	2.034		
	Total	245.770	112			

*Homogeneity of variances confirmed.

Table H5

Post Hoc Analysis (Tukey's Statistic) for Attrition Factors: Professional Community and Science Factors

Attrition Factor	Age Category	Age Category	M diff.	Std. Error	Sig.	95% CI
Professional Community	Less than 30	30-39	3.35417	2.25286	.448	[-2.5, 9.23]
		40-49	-3.22222	2.60138	.604	[-10.01, 3.57]
		50 or older	-.35897	2.16448	.998	[-6.01, 5.29]
	30-39	Less than 30	-3.35417	2.25286	.448	[-9.23, 2.52]
		40-49	-6.57639*	2.45807	.042	[-12.99, -.16]
		50 or older	-3.71314	1.98995	.249	[-8.90, 1.48]
	40-49	Less than 30	3.22222	2.60138	.604	[-3.56, 10.01]
		30-39	6.57639*	2.45807	.042	[.16, 12.99]
		50 or older	2.86325	2.37733	.625	[-3.34, 9.07]
	50 or older	Less than 30	.35897	2.16448	.998	[-5.29, 6.01]
		30-39	3.71314	1.98995	.249	[-1.48, 8.90]
		40-49	-2.86325	2.37733	.625	[-9.07, 3.34]
Science Factors	Less than 30	30-39	-.05208	1.16139	1.000	[-3.08, 2.98]
		40-49	-3.84722*	1.34106	.025	[-7.35, -.35]
		50 or older	-1.58654	1.11583	.489	[-4.50, 1.32]
	30-39	Less than 30	.05208	1.16139	1.000	[-2.98, 3.08]
		40-49	-3.79514*	1.26718	.018	[-7.10, -.49]
		50 or older	-1.53446	1.02586	.444	[-4.21,1.14]
	40-49	Less than 30	3.84722*	1.34106	.025	[.35, 7.35]
		30-39	3.79514*	1.26718	.018	[.49, 7.10]
		50 or older	2.26068	1.22556	.258	[-.94, 5.46]
	50 or older	Less than 30	1.58654	1.11583	.489	[-1.32, 4.50]
		30-39	1.53446	1.02586	.444	[-1.14, 4.21]
		40-49	-2.26068	1.22556	.258	[-5.46, 94]

*Mean difference is significant at the 0.05 level