

EXAMINATION OF HOW PREPARATION PATHWAY AND INDUCTION PROGRAM
COMPREHENSIVENESS ARE ASSOCIATED WITH NOVICE STEM TEACHERS'
PERCEPTIONS OF PREPAREDNESS AND INTENTIONS TO REMAIN IN TEACHING

Lindsay F. Goldberg

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the School of Education (Educational Psychology, Measurement and Evaluation)

Chapel Hill
2012

Approved by:

Dr. Jill V. Hamm

Dr. Judith Meece

Dr. Jeffrey Greene

Abstract

LINDSAY F. GOLDBERG: Examination of How Preparation Pathway and Induction Program Comprehensiveness are Associated with Novice STEM Teachers' Perceptions of Preparedness and Intentions to Remain in Teaching
(Under the direction of Dr. Jill V. Hamm)

Novice science and mathematics (STEM) educators experience high rates of teacher turnover and a shortage of new teachers entering the profession. Variations in the extensiveness of their preservice preparation and on-the-job support services may contribute to these problems. This study examined associations between the comprehensiveness of middle and secondary novice STEM teachers' preparation and induction programs to their perceptions of preparedness and intentions to remain in teaching. Linear and logistic regression analyses revealed that individuals exposed to comprehensive preparation pathways felt more prepared to teach and were more likely to plan to remain in teaching long-term. Likewise, individuals who participated in comprehensive induction programs planned to remain in the profession long-term. These findings suggest that access to comprehensive preparation and induction programs may provide novice STEM educators with the resources needed to feel prepared for the challenges of teaching and aide in their overall commitment to teaching.

Table of Contents

List of Tables	vi
List of Abbreviations	vii
Chapter	
I. Introduction.....	1
II. Theoretical Framework.....	6
Prior Knowledge and Beliefs Contribute to Novice Teachers’ Perceptions.....	6
The Role of Knowledgeable Others in Teacher Development	11
III. Review of the Literature	14
Preparation Pathways.....	15
Induction Programs.....	16
Research on STEM Teachers.....	17
Perceptions of Preparedness	19
Preparation pathway and perceptions of preparedness	21
Induction programs and perceptions of preparedness.....	26
Intentions to Remain in Teaching.....	30
Preparation pathway and intentions to remain in teaching.....	30
Induction programs and intentions to remain in teaching.....	35
Relationship between Preparation Pathway Comprehensiveness and Induction Program Comprehensiveness on Teacher Outcomes	38
IV. The Present Study	41

V. Methods.....	44
Participants.....	44
Procedures.....	46
Measures	47
Preparation pathway.....	48
Induction program.....	52
Perceptions of preparedness.....	55
Intentions to remain in the teaching profession	56
Ethical and Security Considerations	56
Protection of identifiable data.....	56
VI. Plan of Analyses	59
VII. Results	67
Correlational Analyses.....	67
Predicting Novice Teachers' Perceptions of Preparedness	70
Predicting Novice Teachers' Intentions to Remain in the Teaching Profession.....	72
VIII. Discussion	74
Novice Teachers' Perceptions of Preparedness	75
Novice Teachers' Intentions to Remain in Teaching.....	79
Limitations	82
Conclusions.....	88
Appendix A: List of SASS Questionnaires for the 2007-2008 Administration.....	91
Appendix B: Survey Questions, Original Response Options, and Recoded Response Options for Proposed <i>Preparation Pathway</i> <i>Comprehensiveness</i> Variable	92

Appendix C: STEM-related Certification Content Area Codes and Matching Field Area	93
Appendix D: STEM-related Teaching Assignment Codes and Matching Field Area	94
References.....	95

List of Tables

Table 1: Means, Standard Deviations, and Percentages for Teacher Control Variables	45
Table 2: Certification Content Area Codes and Matching Teaching Assignment Field Codes	54
Table 3: Correlation Matrix for Teacher Control Variables	68
Table 4: Correlation Matrix for Teacher Control Variables, Predictor, and Outcome Variables	69
Table 5: Hierarchical Linear Regression Analysis Evaluating Predictors of Novice Teacher Perceptions of Preparedness to Teach	71
Table 6: Binary Logistic Regression Analysis Evaluating Predictors of Novice Teacher Intentions to Remain in Teaching Long-Term.....	73

List of Abbreviations

BTSA	Beginning Teacher Support and Assessment program
CFASST	California Formative Assessment and Support System for Teachers
IES	Institute of Education Sciences
NCES	National Center for Educational Statistics
NCLB	No Child Left Behind Act of 2001
OR	Odds Ratio
PBis	Pearson Point-Biserial
PISA	Programme for International Student Assessment
SASS	Schools and Staffing Survey
STEM	Science, Technology, Engineering and Mathematics
TEAC	Teacher Education Accreditation Council
TIMSS	Trends in International Mathematics and Science Study

CHAPTER 1

INTRODUCTION

Many novice teachers, those educators with three or fewer years of full-time classroom experience, struggle through their first few years of teaching. Vast differences in their preparation pathways, defined as the education and training routes taken by individuals to prepare for the duties of the teaching profession, bring new educators into the occupation with a wide range of experiences. While strong preparation pathways provide opportunities for learning through an inclusive framework of pedagogical instruction, practice teaching opportunities and certification, weak pathways fail to connect these components in a comprehensive and connected manner (Darling-Hammond, Chung, & Frelow, 2002; Teacher Education Accreditation Council, 2012).

The field of teaching has not traditionally provided new educators with the on-the-job support and guidance experiences that are essential to the apprenticeship models commonly employed within other professions, such as medicine and law. Although numerous educators are hired to work in a single school building, teachers are commonly isolated from colleagues and left to themselves to handle a wide range of situations, many which they do not feel adequately prepared to handle (Darling-Hammond, Chung, et al., 2002; Imbimbo & Silvernail, 1999). This “sink or swim” experience can be especially difficult for novice teachers, who are often assigned to highly challenging classrooms during their early years in the occupation, and likely contributes to high rates of teacher turnover among inexperienced teachers (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004). In 2010, approximately 40% of

teachers reported leaving the profession within the first five years of teaching (Donaldson & Johnson, 2010). Turnover rates for teachers are higher than for many other professionals including lawyers, engineers, and professors. With high levels of teacher turnover, students are likely to experience a series of novice teachers, whose lack of experience and poor perceptions of preparedness may negatively affect student motivation and achievement (Darling-Hammond, Chung, et al., 2002).

One area in which the effect of high teacher turnover rates is most apparent is in the fields of science, technology, engineering, and mathematics, also known as the STEM fields. The shortage of quality STEM teachers in the profession is currently an issue of grave concern for hiring managers in many schools. Lawrenz and colleagues (2006) found that 95% of urban school districts were in immediate need of science and math teachers at the high school level, while 80% were in need of a middle school STEM teacher. Other research also demonstrates that 56% of students in science classes are being taught by an out-of field teacher, while 27% of students in mathematics face a similar situation (Ingersoll, 1999; Ingersoll, 2002). While these statistics demonstrate the importance of bringing and keeping quality STEM teachers into today's middle and secondary schools, according to Ingersoll (2011), little research has actually been conducted on the supply and demand of math and science teachers. Even with the issue at the forefront of education reform initiatives, the ability to recruit and retain qualified STEM teachers has made little progress.

Since the beginning of the 21st century, the subjects related to the STEM fields have increasingly become high in demand. Many view the skills learned in these fields, such as higher order thinking and problem solving, as pertinent for students to obtain in order to be competitive in an ever-expanding global society (Beers, 2011; Dickman, Schwabe, Schmidt,

& Henken, 2009; National Research Council, 2011). With America's recent drop in the rankings on tests of international comparisons, such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) assessments, many education reformers have expanded efforts to increase students' access to these topics in schools, particularly at the middle and high school levels, grades six through 12 (President's Council of Advisors on Science and Technology, 2010). However, without sound research on the unique challenges faced by teachers in the STEM fields, many of these reform efforts may not have long-term effects on student achievement. As the statistics demonstrate, there is an immediate need to examine STEM teachers starting in their preparation programs and progressing through their early years of teaching in order to gain a better understanding of the roadblocks affecting the ability to attract *and keep* quality STEM teachers in the classroom.

Although research specific to STEM teachers has received little focus, over the past two decades increased attention has been paid to the challenges novice teachers, in general, face when entering the profession and the effects of these struggles on long-term teacher retention (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004). This newfound awareness has led to the establishment of induction programs, which are collective groups of programs aimed to provide support, guidance, and orientation to novice teachers (Smith & Ingersoll, 2004). The goal of such programs is to enhance teacher quality and prevent the pre-retirement exit of educators, through increased teacher retention, in order to improve student learning. Although mandatory, formal, and standardized induction programs do not exist, in 2008 nearly 80% of beginning teachers reported participation in an induction program during their first year of teaching (Flanagan & Fowler, 2010).

While research on novice teachers' preparation pathways and induction programs has become prevalent over the past two decades, many gaps in the literature still exist in understanding the effectiveness and benefits of these programs. In particular, more research is needed to further our understanding of the relationship between preparation pathways and novice teachers' intentions to remain in the profession, particularly for STEM educators. Intentions to remain in teaching often serve as a proxy for teachers' commitment to the profession and likelihood of retention when actual measures of retention and attrition are unavailable. Recent research suggests that teachers' level of commitment to the profession may play a key role in their decision to remain in the field (Corbell, 2008; Corbell, Booth, & Reiman, 2010; Johnson & The Project on Next Generation of Teachers, 2004). Additional research is also needed to understand the extent to which participation in an induction program is associated with novice teachers' perceptions of preparedness, or their beliefs of how ready they are to perform the duties required of the profession (Darling-Hammond, Eiler, & Marcus, 2002). Furthermore, more research is needed in order to understand if induction programs are helpful for novice teachers regardless of the quality of their preparation pathway or whether these support services provide greater benefits for novice teachers from weak preparation pathways.

The purpose of the present study is to explore how preparation pathways and induction programs relate to middle and secondary novice STEM teachers' perceptions of preparedness during their first year in the profession and their plans to remain in teaching. The current study extends upon prior research from Ingersoll and Strong (2011) on the impact of teacher preparation and induction on novice teachers' preparedness and retention, by uniquely focusing on teachers in the science, technology, engineering, and mathematics

(STEM) fields. To assess the relationship among these factors, I utilized the 2007-2008 Schools and Staffing Survey (SASS), conducted by the Department of Education's National Center for Educational Statistics (NCES) (U.S. Department of Education, 2008). Focusing on middle and secondary novice STEM teachers with three or fewer years of full-time classroom experience, I address the following research questions:

- RQ1: What is the relationship between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and their perceptions of preparedness?
- RQ2: What is the relationship between the comprehensiveness of middle and secondary novice STEM teachers' induction programs and their perceptions of preparedness?
- RQ3: Does the comprehensiveness of middle and secondary novice STEM teachers' induction programs moderate the relationship between preparation pathway comprehensiveness and perceptions of preparedness?
- RQ4: What is the relationship between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and their intentions to remain in the teaching profession?
- RQ5: What is the relationship between the comprehensiveness of middle and secondary novice STEM teachers' induction programs and their intentions to remain in the teaching profession?
- RQ6: Does the comprehensiveness of middle and secondary novice STEM teachers' induction programs moderate the relationship between preparation pathway comprehensiveness and intentions to remain in the teaching profession?

CHAPTER 2

THEORETICAL FRAMEWORK

The conceptual framework for this study was derived from two bodies of literature: the contributions of prior knowledge and beliefs to novice teachers' perceptions, and the contributions of knowledgeable others to teacher development. Research findings of Feiman-Nemser (2001) and Warford (2010) emphasize the importance of sustained learning experiences for teacher candidates and novice teachers as they progress from preparation through the early years of their careers. The researchers examine the influence of teacher candidates' own schooling experiences on their teacher preparation and development, and consider how on-the-job connections and learning opportunities may have great implications for novices' learning. The current study draws upon this research literature to examine the extent to which novice teachers perceive themselves to be prepared for the responsibilities of their job and intend to make teaching a long-term career.

Prior Knowledge and Beliefs Contribute to Novice Teachers' Perceptions

All prospective teachers bring a set of prior knowledge and beliefs to their preservice education and student teaching experiences (Feiman-Nemser, 2001; Luft, Firestone, Wong, Ortega, Adams, & Bang, 2011; Warford, 2010). Having been learners themselves throughout their primary and secondary education, prior experiences may mislead teacher candidates into believing that they know more about teaching than they actually do (Feiman-Nemser, 2001). These prior beliefs, or firmly held convictions about what it means to be an educator, may make it difficult for teacher candidates to form new pedagogical concepts and practices.

Instead, teacher candidates may stall their knowledge advancement by referring to outdated beliefs, such as lecturing and direct instruction, that are commonly based upon experiences they were most familiar with from their own education (Warford, 2010). Even as more contemporary approaches to pedagogy have emerged, such as constructivist and discovery-based approaches, the “sink or swim” scenario many novices face during their first years in the profession make it likely that they will fall back upon their previous experiences and beliefs in challenging situations.

Feiman-Nemser (2001) asserted that there is a lack of connectivity between teacher preparation pathways and the realities of the teaching field and school environments. In her discussion of designing a preparation-to-practice continuum for novice teachers, she acknowledged that disparities between the ideological theories presented in traditional preparation programs and the actuality of instructional practice inhibits individuals from making a smooth transition from learner to teacher. With such a large disconnect, novice teachers enter the workforce unprepared to handle the expectations of contemporary pedagogy. In order to resolve such disparities, Feiman-Nemser (2001) developed a framework for a “powerful curriculum” that situated teacher learning into three stages that span through the novice years of teaching. Each of the three stages, overlapping from preservice preparation to induction to post-induction professional development, revolved around a central task that provided a continuum of teacher learning and prepared new educators for the challenges of modern education. These central tasks consider the unique learning needs of teachers as they progress through different stages of their preparation and early teaching career (Feiman-Nemser, 2001). During preservice preparation, for example, teacher candidates focus on analyzing their beliefs and forming new ideas about what it

means to be an effective teacher. As they progress through induction and their early teaching careers, novices develop a professional identity of teaching in relation to their local knowledge of the school, students, and community. Teachers then use this gained knowledge to strengthen their teaching skills further through post-induction professional development opportunities.

In his recent research on the zone of proximal *teacher* development, Warford (2010) advances Feiman-Nemser's powerful curriculum model by applying a Vygotskian approach to teacher development to argue that a preparation that focuses on connecting theory to practice prepares teacher candidates to handle a range of classroom situations. Warford (2010) uses a three-way model that incorporates teachers' beliefs about pedagogy from their prior experiences as students into the content and context of their teacher preparation program and field placement experiences. In doing so, he emphasizes a quality preparation pathway that acknowledges teacher candidates' prior knowledge and beliefs, reflects upon and critically examines those beliefs, and connects the theoretical ideas of preparation programs to the practical application of teaching experiences.

In order to properly prepare teacher candidates for the challenges and complexities of the contemporary classroom, Warford (2010) argues that teacher preparation programs must acknowledge teacher candidates' prior knowledge and beliefs and critically examine their ideas in the context of a modern educational framework. Aligned with this framework, and the work of Feiman-Nemser (2001), is the notion that a strong educational background and quality training experiences constitute the preparation pathway for teacher candidates. The strength or weakness of these pathways greatly influences the ideologies and beliefs novice teachers bring with them to the profession. According to the Teacher Education

Accreditation Council (TEAC), a non-profit organization devoted to accrediting teacher education programs, components of a quality teacher education program include evidence of candidate learning, with a particular emphasis on developing the following: (a) subject matter knowledge, (b) pedagogical knowledge, (c) effective teaching skills, and (d) a demonstrated understanding of knowing how to independently learn (Teacher Education Accreditation Council [TEAC], 2012). In order to further understand the association between novice teachers' preparation pathways and their perceptions of preparedness, it is essential to examine the strength and quality of novice teachers' education and training programs.

The role of teacher preparation programs is to "...prepare competent, caring, and qualified educators" (TEAC, 2012) and, at their core, teacher preparation programs must produce educators who are knowledgeable of the subject matter they teach. In assessing the strength of a teacher preparation program for teacher candidates, it is important to review candidates' major field of study, status on national teacher exams of subject matter skills, and teaching certification areas. Understanding how well qualified novice teachers are within their specific subject areas provides valuable information regarding their expected subject matter knowledge, and subsequent perceptions of preparedness, during their first year in the profession (Feiman-Nemser, 2001).

Under the provisions of the No Child Left Behind Act of 2001 (NCLB), K-12 educators who instruct the core subject areas of English and language arts, mathematics, science, social sciences (i.e., geography, civics, government, economics, history), and foreign language must demonstrate that they are highly qualified to teach (No Child Left Behind [NCLB], 2001). Highly qualified teachers must hold a minimum of a bachelor's degree and be fully certified by the state in which they teach, in some cases also passing their individual

state's licensing exam (NCLB, 2001). Highly qualified teachers must also demonstrate competency in the subject area or areas taught, as identified by receiving a passing grade on tests of teaching skills and specific-content knowledge, such as the Praxis I Pre-Professional Skills Test and the Praxis II: Subject Assessment (NCLB, 2001). Those teachers who are designated as highly qualified are considered proficient in subject matter competency and are likely to demonstrate perceptions of confidence and preparedness in the instructional areas in which they teach (Tamir, 2010).

Teacher candidates must also have pedagogical knowledge and be able to convert their subject matter knowledge into an instructional form that accommodates a range of student learners (TEAC, 2012). Pedagogical knowledge helps teachers ensure that the contents of their lessons are understandable for students. If students find the content confusing or difficult, teachers should use their pedagogical knowledge to prepare alternative explanations or models using a variety of curricular materials (Feiman-Nemser, 2001, Luft et al., 2011). By incorporating contemporary approaches to pedagogy into their instructional practices, teacher educators from quality preservice preparation programs ensure that graduates enter the profession with the pedagogical skills needed to be an effective educator. Using courses in instructional theories and teaching strategies and methods, teacher educators break down candidates' misconceptions, build up the knowledge teacher candidates bring with them to the program, and educate their students on subject-specific and contemporary teaching methods (Feiman-Nemser, 2001; Sigler & Saam, 2006).

Student field experiences enable teacher candidates to apply the knowledge, theories, and strategies taught in their courses to investigate issues and analyze challenging situations in an independent learning environment (Feiman-Nemser, 2001). Programs that offer

extended field experiences that move from observation and limited participation to full classroom teaching responsibilities slowly provide teacher candidates with the tools needed to become independent learners (Warford, 2010). Effective preparation programs that combine journal writing, cohort seminars, and one-on-one conferences, enable teacher candidates to not only reflect on and analyze their own experiences, but also share in the lessons learned by others (Feiman-Nemser, 2001). These experiences further improve teacher candidates' skills and help shape teachers' effectiveness once they enter the field.

Preparation pathways that embody Feiman-Nemser's (2001) "powerful curriculum" and Warford's (2010) teacher development model demonstrate the importance of quality education programs in the development and preparation of novice teachers. Experiencing such pathways enables teacher candidates to integrate their prior knowledge and beliefs and astutely assess the accuracy of those beliefs in the context of modern education. Furthermore, quality preparation pathways train individuals for the unforeseen challenges of the profession and provide candidates with the tools needed to become independent learners and educators.

The Role of Knowledgeable Others in Teacher Development

A Vygotskyan approach to teacher education focuses on teacher development as a situated learning experience, in which the learning context is embedded in a cultural and social environment (Warford, 2010). Induction programs build upon the ideas of situated learning by providing novice teachers with on-the-job support and training within the context of the school environment in which they teach. Induction programs are viewed as a bridge that connects novice teachers' varying preparation pathways to their roles as educators (Ingersoll & Strong, 2011). Induction programs allow for the skills and knowledge that were not obtained during pre-service preparation to be acquired on the job as novice teachers

further their understanding of what it takes to be a successful educator (Ingersoll & Strong, 2011).

Induction programs are seen as a transition from preparation to practice in which novices go from being a student, examining education as a formal study, to becoming an instructor (Feiman-Nemser, 2001, Luft et al., 2011). This shift in roles, however, also reveals gaps in novice teachers' knowledge and skills. Teaching, like many other professions, is a complex occupation; no matter how effective a preparation pathway is, certain aspects of expertise can only be obtained through experience (Berliner, 1986; Feiman-Nemser, 2001). In this regard, the role of knowledgeable others becomes crucial in providing novices with the knowledge and skills needed to succeed in the day-to-day challenges associated with the teaching profession.

The role of knowledgeable others in induction programs is commonly provided by more experienced educators, known as mentors, as well as through collaboration with colleagues within a department or subject. Effective induction programs also provide novice teachers with appropriate assignments and assistance, such as reduced teaching schedules and classroom assistance, as they learn the norms, rules, and responsibilities of their work environment and occupation (Smith & Ingersoll, 2004). These accommodations allow novices to have specific times of day to plan their lessons and meet with their mentors to reflect on their classroom experiences. A school culture that is collaborative in nature enables novices to feel comfortable seeking out assistance and aid (Feiman-Nemser, 2001; Klassen & Chiu, 2011). Since the first few years of teaching are formative, the environment in which novices teach and the experiences novices face within that time frame significantly impacts both their decision to make teaching a long-term career as well as the type of teacher they

become (Feiman-Nemser, 2001; Klassen & Chiu, 2011).

Those who mentor novice teachers through induction programs should be aware of the influence of contextual factors on learning and provide scaffolding, or guided and fading support, not just to build up novice teachers' skills, but to introduce novices to the social, cultural, and collaborative learning environments present in schools (Warford, 2010). As Putnam and Borko (2000) state, "learning is as much a matter of enculturation into a community's ways of thinking and dispositions as it is a result of explicit instruction in specific concepts, skills, and procedures" (p. 5). Contemporary research on learning recognizes the importance of the role of knowledgeable others in this process of constructing knowledge (Putnam & Borko, 2000). The social interactions that occur between a novice and a mentor provide more than encouragement and stimulation, but rather help to construct what is learned and how that learning takes place.

CHAPTER 3

REVIEW OF THE LITERATURE

In the current study, I investigated the association between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and induction programs to outcomes of perceptions of preparedness and intentions to remain in the teaching profession. Through this examination, I found the nature of these relationships to be variable. For example, research on the relationship between novice teachers' preparation pathways and their perceptions of preparedness to teach revealed mixed findings. While some researchers (Darling-Hammond & Cobb, 1996; Imbimbo & Silvernail, 1999; Turley & Nakai, 2000) claimed that the *type* of preparation pathway obtained (e.g., traditional vs. alternative) was a significant factor in determining novice teachers' perceived preparedness, others (Iyer & Soled, 2007) found no significant difference. On the other hand, some relationships were more clearly defined. Research on the relationship between induction programs and teacher retention demonstrated that participation in an induction program significantly increased teacher retention rates (Smith & Ingersoll, 2004).

Still other research on the variables of interest was difficult to find. In particular, evidence on the relationship between novice teachers' preparation pathways and their intentions to remain in the teaching profession was lacking. Likewise, information on valuable preparation and training opportunities for STEM teachers were nearly nonexistent. The following review of the literature provides possible explanations for the variable findings of previous research, and reveals gaps in the literature that the present study attempts to fill.

The literature review begins with background on the diversity of preparation pathways and induction programs that novice teachers encounter as they prepare for and enter the teaching profession. Next, an introduction to contemporary research on STEM teachers is presented as it relates to the key associations investigated in the current study. Then, the outcome variables (i.e., perceptions of preparedness and intentions to remain in the teaching profession) are discussed along with further elaboration of the available research on the relationships between preparation pathways, induction programs, perceptions of preparedness, and intentions to remain in teaching. The literature review concludes with an examination of possible interactions between the main predictor variables and their effects on novice teacher perceptions and intentions.

Preparation Pathways

Novice teachers enter the profession from diverse preparation pathways, particularly in terms of the educational and training routes towards certification in the profession (Darling-Hammond, Chung, et al., 2002; Freedman & Appleman, 2009; Unruh & Holt, 2010). Novice teachers who take a traditional route to certification complete a four-year program that commences with a degree, at the Bachelor's level or higher, in education or a related field. Traditional pathways commonly involve completion of courses in teaching methods and strategies, which help build teacher candidates' pedagogical knowledge and self-efficacy for handling an array of classroom situations (Unruh & Holt, 2010; Yost, 2006). These programs commonly incorporate hands-on training experiences as well, such as student teaching opportunities, which provide opportunities for teacher candidates to reflect upon their teaching abilities and receive feedback from faculty and peers (Darling-Hammond, Chung, et al., 2002; McIntyre, Byrd, & Foxx, 1996). Furthermore, teacher

candidates from a traditional route are commonly prepared for national tests of teaching skills and obtain their licensure and certification through their educational program.

Alternative routes to entry and certification in the teaching profession, such as lateral transition programs or Teach for America, enable individuals to enter the workforce at an accelerated pace, often while simultaneously completing their coursework and certification (Turley & Nakai, 2000; Unruh & Holt, 2010). Many individuals who proceed through an alternative route to teacher entry have passed a required basic skills test, such as the Praxis I Pre-Professional Skills Test, but lack the field experiences that are an essential component of traditional teacher education programs (Unruh & Holt, 2010).

As individuals start their careers as teachers, they are likely to carry facets of these education and training experiences throughout their initial years in the profession. Differences in the education and certification routes of novice teachers may account for disparities in their perceptions of preparedness and intentions to remain in the profession long-term. With nearly a third of all novice teachers entering the workforce through an alternative certification route, it is imperative to understand more fully the unique needs and perceptions of these groups of individuals (Unruh & Holt, 2010) in addition to the needs and characteristics of traditionally prepared teachers.

Induction Programs

Induction programs vary in breadth; some programs are narrow and include only a mentoring component, while others involve a comprehensive arrangement of reduced teaching schedules, common planning time with teachers who also teach the same subject, classes or seminar opportunities, and supportive communication with administrators and fellow teachers, among other components (Smith & Ingersoll, 2004; U.S. Department of

Education, 2008). Similarly, induction programs vary in terms of their length and depth. In certain programs, novice teachers are provided with guidance and support throughout the entire school year, while in other situations induction programs are synonymous with a short-term orientation program at the beginning of the school year (Smith & Ingersoll, 2004). Likewise, some programs involve multiple sessions with mentors, fellow colleagues, and administrators, while others only incorporate a single meeting session (Smith & Ingersoll, 2004). Findings from a number of studies provide insight into which aspects of these programs are associated with teachers' perceptions of preparedness and plans to remain in the profession.

Research on STEM Teachers

Today, the focus of education is shifting towards college- and career readiness and students' obtainments of 21st century skills in order to maintain America's presence as a leader in a globally competitive society (President's Council of Advisors on Science and Technology, 2010). This shift is increasing requirements in math and science for many middle and secondary students, intensifying the demand for STEM educators (Ingersoll, 2011). Nevertheless, there are fewer STEM teachers entering the field than teachers of other subject areas, such as English, of which there is a surplus of candidates. Additionally, relatively few STEM teachers who do enter the profession come from a traditional teacher preparation program. Instead, nearly 75% of new STEM teachers entering the schools come from non-education backgrounds in science or math (Ingersoll, 2011). While this preparation route may result in STEM educators who have sufficient subject-matter knowledge, their pedagogical skills and teaching experiences are likely to vary considerably.

Recent research findings by Ingersoll and colleagues (Ingersoll, 2011; Ingersoll &

May, 2010; Ingersoll & Perda, 2010) suggest that, although fewer STEM teachers are entering the profession as a whole, the ability of districts to hire teachers for these subjects has been quite steady. Furthermore, the rate of hiring of STEM teachers seems to keep pace with the rate of teacher retirements in these fields. The researchers concluded that issues related to STEM teacher recruitment is not as much an issue of insufficient *production* of new STEM teachers as it is the issue of *attrition* of current STEM teachers leaving the field long before retirement age. When the loss of pre-retirement-aged teachers is taken into account for the STEM field, the data appear to demonstrate a problem of supply-and-demand as opposed to the real issues related to attrition and retention (Ingersoll, 2011).

Similar to teacher turnover rates for novice teachers in other subject areas, the highest rates of STEM teacher turnover appear to occur in disadvantaged public schools. Many STEM teachers cite issues related to job conditions, such as a lack of resources, poor school leadership, high levels of student misbehavior, and little opportunity for professional development and collaboration among educators as the root cause of their leaving (Ingersoll, 2011). In light of these findings, examining novice STEM teachers' perceptions of preparedness to teach and intentions to remain in teaching in relation to the comprehensiveness of their preparation pathways and induction and support services is key to furthering our understanding of why many individuals in this select subset are conducting an early exit from teaching and contributing to the shortage of STEM teachers in today's middle and secondary public schools. The following review examines the relationships between the main variables of interest more fully as they relate to teacher outcomes of perceptions of preparedness to teach and intentions to remain in the teaching profession.

Perceptions of Preparedness

As novice teachers transition from their preservice training to their full-time career as educators, they are faced with many challenges that they may or may not have been adequately prepared to handle. While on-the-job support services, in the form of induction programs, are offered to help these new educators adjust to these changes, certain aspects of teaching are likely to reveal a degree of uncertainty among novice teachers. Previous research on novice teachers entering the profession has focused on how the quality of their teacher training or the availability of support services affects outcomes, such as novice teachers' impact on student achievement or long-term retention of novice teachers (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Darling-Hammond, 1999; Ingersoll & Strong, 2011; Rockoff, 2004; Smith & Ingersoll, 2004). Little research has been conducted, however, on novice teachers' perceptions of preparedness to teach once they enter the profession.

Perceptions of preparedness offer insight into novice teachers' thoughts and feelings about their ability to perform as effective educators (Darling-Hammond, Eiler, & Marcus, 2002). Teachers' perceptions provide information regarding the areas of teaching a novice feels prepared to handle (e.g., classroom management, student assessment, instructional methodology and curriculum development) and, more importantly, the areas in which they do not feel prepared. Today, exposure to challenging job conditions and placements in lower-performing schools place increased demands on middle and secondary novice STEM teachers. As a result, novice teachers' preparation pathway and induction program trainings may not fully address the complex situations novice teachers face in the classroom (U.S. Department of Education, 1999). Therefore, it is important to review how novice STEM teachers perceive their preparedness to teach in order to gain an understanding of how the

challenges they face upon entering the profession affect their teaching ability, self-efficacy, and long-term commitment to the profession.

Perceptions of preparedness may be considered an important factor that supports the development of strong self-efficacy beliefs in new teachers. According to Bandura's (1995) social cognitive theory, self-efficacy is described as "the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations (p. 2)". In the context of teaching, self-efficacy can be described more specifically as "a teacher's belief in her own ability to plan and implement action that results in the successful delivery of a teaching task in a given context" (Tschannen-Moran, Hoy, & Hoy, 1998). Studies have shown that novice teachers' self-efficacy beliefs directly impact their perceptions of preparedness and are usually developed early in their career (Hayes, 2009; Hoy & Spero, 2005; Moore-Hayes, 2008). Therefore, in the context of the present study, understanding novice teachers' perceptions of preparedness to manage classroom situations, adapt materials to the needs of the students, teach their subject matter, and assess students may serve as an indicator of their self-efficacy as a teacher.

According to recent research, perceptions of preparedness may also be related to novice teachers' ability to persist in the teaching profession (Kinne, 2011). Feelings of competence in a job, a component of self-efficacy, have been found to be associated with high self-esteem and increased involvement in a career (Jorissen, 2003). Self-efficacy also influences the amount of effort put forth and an individual's resilience in responding to setbacks and failure (Bandura, 1997). In the context of the teaching profession, a teacher who feels confident in his or her ability to perform the duties of the job is more likely to show a greater investment in remaining in the profession than a teacher who lacks that confidence.

Translated to perceptions of preparedness, these findings indicate that those novice teachers with more favorable perceptions of preparedness to teach may view their commitment to remaining in the profession differently than those educators with less favorable perceptions of preparedness.

Preparation pathway and perceptions of preparedness. Research findings on the relationship between education and training routes and novice teachers' perceptions of preparedness are mixed. Results of some studies suggest that traditional routes better prepare novice teachers with the pedagogical skills and training experiences needed to be appropriately prepared for the challenges of the teaching profession (Darling-Hammond & Cobb, 1996; Imbimbo & Silvernail, 1999; Turley & Nakai, 2000), while other findings indicate that teachers from alternative routes are more competent in their subject area and receive the needed guidance and support through their induction program (Iyer & Soled, 2007; Unruh & Holt, 2010). Furthermore, research findings are inconclusive regarding the extent to which novice teachers, regardless of preparation pathway, are prepared for the real-world experiences of teaching as a whole.

Darling-Hammond and Cobb's (1996) meta-review of the research on traditional and alternative routes to certification revealed that teachers who completed a traditional preparation pathway were significantly better prepared than alternate route teachers in areas of classroom management, teaching strategies, evaluation and assessment of students, and curriculum development. Evertson and colleagues (1985) found that traditionally prepared teachers were more satisfied with the quality of their preparation program, were found to be more effective with students, and reported fewer challenges when beginning as full-time teachers, as compared to alternatively prepared teachers (Evertson, Hawley, & Zlotnick,

1985). The researchers also noted that much of the success of teachers from traditional route programs was linked to their ability to connect theory and practice, through coursework and student teaching experiences (Darling-Hammond & Cobb, 1996).

Turley and Nakai (2000) examined perceptions of traditionally prepared versus emergency permit teachers in the ability of their preparation pathways to prepare them for the complexities of the teaching profession. Emergency permit teachers in this study experienced similar preparation as their traditionally prepared counterparts with the exception of student teaching experience. Previous research by McIntyre, Byrd, and Foxx (1996) had emphasized the importance of this crucial aspect of teacher candidates' preservice preparation. According to the researchers, student teaching enables teacher candidates to reflect and analyze their strengths and weaknesses as educators and provides the opportunity for teacher candidates to receive feedback from higher education faculty, school faculty, and their peers. (McIntyre, Byrd, & Foxx, 1996). By contrast, traditionally prepared teachers in this study completed their student teaching training through two field placements that altogether spanned 15 weeks (Turley & Nakai, 2000).

Analysis of survey data, collected from four cohorts of students over four consecutive semesters, indicated that both emergency permit teachers and traditional route teachers were satisfied with their preparation pathways. However, many emergency permit teachers reported feeling unprepared for the full responsibilities of classroom teaching, without the support and guidance of a student teaching experience (Turley & Nakai, 2000). Many expressed the concern that they lacked the instructional techniques and classroom management skills needed to be an effective educator. In spite of these negative perceptions of preparedness, interestingly, many also noted that they would choose the same route if

asked to do it again (Turley & Nakai, 2000). In particular, emergency permit teachers noted that the opportunity to learn how to teach through real-life experiences and their independence as the sole teacher in the classroom were main advantages of taking an alternative route to teaching. In addition, economical reasons, such as financial rewards, also played a significant role in emergency permit teachers' willingness to choose the same route, if asked to repeat their teacher preparation. These findings indicate that although the student teaching component may provide teacher candidates with more favorable perceptions of preparedness when entering the field, those who lack this component within their preparation may be able to overcome their lack of training through experience and support from their school community. Furthermore, differing routes of preparation may attract different teacher candidates, depending on economic circumstances and personal confidence levels.

In 1998, through a collaborative effort between the National Commission on Teaching and America's Future and the United Federation of Teachers, nearly 3,000 novice teachers in New York City were surveyed regarding their perceptions of preparedness for teaching (Imbimbo & Silvernail, 1999). The majority of teachers in this sample felt unprepared when entering the profession in the following areas: subject area knowledge, instructional strategies, and effective classroom management. In order to further understand these findings, Imbimbo and Silvernail (1999) divided the sample into three groups: (a) non-state-certified teachers; (b) state certified teachers who successfully completed a teacher education program; and (c) state certified teachers who received their certification through a non-matriculating program (i.e., by completing the required education courses without obtaining a degree). Within these sub-samples, teachers who did not have any state certification felt significantly less prepared than those teachers who were certified.

Furthermore, the completion of an education program made a significant difference in terms of overall perceptions of preparedness. Among the certified teachers in the study, state-certified teachers who successfully completed a teacher education program felt significantly greater perceptions of preparedness than did state-certified teachers who did not obtain a degree (Imbimbo & Silvernail, 1999).

Results from this study identify important components of novice teachers' preparation pathways that are associated with perceptions of preparedness. In particular, state certification and the completion of a bachelor's degree in education appear to produce novice teachers with greater perceptions of preparedness than novice teachers who lack those qualifications. While this study was limited to a sample of novice teachers from a specific geographic region of the country, the findings nevertheless revealed the importance of education and certification in novice teachers' overall perceptions of preparedness when first entering the field. Additional studies, examined further in this section, reveal more about the specific program components that may be key contributors to perceptions of preparedness.

Results of a recent study that compared three different teacher preparation programs (i.e., traditional undergraduate education program, masters with licensure program, and alternative certification program) found that teacher candidates did not differ in their perceived preparedness based on their educational preparation route (Iyer & Soled, 2007). One possible explanation for these findings was that the alternatively certified participants tended to be older than the traditionally certified teachers; their life experiences and maturity may counteract the missing experiences their traditionally certified teachers were provided and equalize their perceptions of preparedness when entering the field (Iyer & Soled, 2007).

Although the results of this study revealed information about perceptions of

preparedness of teachers entering the field from a variety of backgrounds, it was limited to teacher *candidates* whose experiences in real-world classroom situations were confined to student teaching and internship opportunities. In the current study, the association between preparation pathway and perceptions of preparedness for novice teachers during their *first year* of full-time teaching experience is considered. An important distinction should be made regarding the difference between teacher candidates and novice teachers. Many teacher candidates in the process of student teaching are still receiving consistent feedback from peers and higher education faculty within their preparation program. This feedback, along with other coursework, provides the opportunity for teacher candidates to reflect and analyze upon their student teaching experiences (McIntyre, Byrd, & Foxx, 1996). Novice teachers, on the other hand, are not always provided with feedback and reflection opportunities. While previous research on *teacher candidates* can provide valuable information about perceptions of preparedness, it is important to realize that findings from this group are limited in the ability to provide informed and accurate information about how *novice teachers* perceive their preparation to teach, independent of additional support and guidance.

Taken together, the results of these studies do not suggest strong differences in novice teachers' perceptions of preparedness based on the *type* of preparation pathway (i.e., traditional vs. alternative route) acquired. Rather, other factors, such as the *coverage* of the preparation pathway may play a more significant role in the relationship between novices' preparedness perceptions based on their educational and training backgrounds. In examining the quality of a preparation pathway, it is important to take into account which components (i.e., courses in teaching methods and strategies, extensive student teaching experiences, etc.) are related to novice teachers' perceptions of preparedness. It is likely that novice teachers

who completed preparation pathways that included a significant number of these components, regardless of traditional or alternative routes, will report greater perceptions of preparedness than those novice teachers whose preparation pathways were not as comprehensive.

Induction programs and perceptions of preparedness. Research suggests that quality induction programs have significant impacts on novice teacher development. Well-designed programs that include collaboration among teachers, support from administrators, and mentoring, as well as opportunities for observation and professional development training, can improve novices' pedagogical skills, feelings of self-efficacy, and attitudes about teaching (Andrews & Martin, 2003).

Fulton and Britton (2011) examined the relationship between STEM teacher effectiveness and other outcomes with teachers' participation in strong professional learning communities in their schools. The researchers noted that teachers who were able to collaborate with colleagues in a productive and supportive environment were more satisfied with their career and were more likely to remain in teaching long-term. Their research analyzed this trend further by investigating the impact of learning teams on teacher practices among STEM teachers. They found that STEM teachers who participated in learning teams understood their subject matter better and felt more prepared to teach in their subject than those STEM teachers who were not able to participate in such collaboration with colleagues (Fulton & Britton, 2011). This finding provides support for the relationship that is hypothesized for the present study, that novice STEM teachers who participate in a comprehensive induction program that includes collaboration with colleagues, among other factors, have more favorable perceptions of preparedness to teach than novice STEM

teachers who did not participate in a comprehensive induction program. The current study extends and expands upon this knowledge by investigating these relationships within a nationally representative sample of novice STEM teachers in the middle and secondary levels. Moreover, the current study includes an additional outcome component by comparing the comprehensiveness of novice STEM teachers' induction program to both their perceptions of preparedness to teach and their intentions to remain in the teaching profession.

Flanagan and Fowler (2010) explored the relationship between novice teachers' induction program participation and their feelings of preparedness, using the 1999-2000 public-use SASS. First-year teachers who participated in an induction program felt more prepared to teach, compared to first-year teachers who had not experienced an induction program. However, the mean difference in feelings of preparedness between the groups (i.e., induction vs. non-induction participants) was minimal, leading the authors to conclude that induction program participation may be associated with higher feelings of preparedness in first year teachers, but other factors may have a strong influence as well, including individuals' self-efficacy beliefs.

Previous research has also focused on the association between induction program participation and teacher outcomes related to perceptions of preparedness, such as feelings of support and pedagogical competency. Thompson, Paek, Goe, and Ponte (2004) examined the impact of induction program participation on novice teachers' pedagogical practices. Using the State of California's Beginning Teacher Support and Assessment (BTSA) program and the California Formative Assessment and Support System for Teachers (CFASST), the researchers surveyed 1,125 third- to fifth-grade teachers who were currently in their third year of teaching (Thompson, Paek, Goe, & Ponte, 2004). Respondents were categorized as

being highly, moderately, or minimally engaged in their induction program. In the context of this study, *engagement* referred to the amount of exposure a novice teacher received in the support program (i.e., BTSA, CFASST). After obtaining survey data responses, the researchers then interviewed and observed a smaller subset of teachers. Nine measures of novice teachers' pedagogical practices were obtained including: instructional planning, teacher reflection on their practices, feedback practices, and depth of student understanding. The researchers concluded that teachers who were highly engaged in their induction program scored higher on measures of pedagogical practices than did teachers who were minimally engaged, for seven out of nine measures. These findings demonstrate a link between teacher induction program participation and novice teachers' pedagogical skills and potentially, their perceptions of preparedness. These results reveal that the level of a teacher's involvement in an induction program may have a significant impact on their development as a teacher.

A study conducted by researchers Andrews and Quinn (2005) used Likert-type questionnaires and open-ended comment boxes to examine the effects of mentoring on first-year teachers' perceptions of support received. Through surveying first-year teachers who were assigned either a mentor through their school district's mentor program, a mentor through their principals, or no mentor, the researchers sought to determine if novice teachers in these three groups differed significantly in their perceptions of the amount of support received during their first year of teaching. Novice teachers with a district-assigned mentor felt they had received significantly more support than novice teachers who were not assigned any mentor. Teachers who reported high perceptions of support indicated factors such as team teaching, a supportive staff, and a family atmosphere in which they could go to anyone for help as significant influences that promoted their sense of support (Andrews & Quinn,

2005). On the other hand, teachers who scored low on the total support scale reported mentor mismatching and unsupportive school climates as reasons for their minimal perceptions of support.

To further analyze the data, the researchers reviewed the five main areas of support that were addressed through the questionnaires: (a) instruction and curriculum assistance; (b) personal and emotional support; (c) resource assistance; (d) policy and procedure information; and (e) classroom management help. Novice teachers reported that they received the most support in areas of personal and emotional support as well as policy and procedure information and the least support in the areas of instruction and curriculum and resource assistance. The researchers concluded that more emphasis needed to be placed on mentors assisting new teachers in areas of lesson planning, classroom observations, and constructive feedback (Andrews & Quinn, 2005). Furthermore, they argued that schools need to prioritize time for mentors and mentees to meet and incorporate conferencing into the design of their induction programs.

The current literature revealed that participation in an induction program improved novice teachers' preparedness to teach their subject matter and enhanced their pedagogical skills (Fulton & Britton, 2010; Thompson, Paek, Goe, & Ponte, 2004). However, extensive research on the direct impact of induction programs on novice teacher perceptions of preparedness to teach is still lacking. Results of the present study aim to increase our knowledge of this lesser researched outcome in order to gain a better understanding of the manner in which novice teachers' induction programs affect their perceptions of preparedness to teach.

Intentions to Remain in Teaching

The relationship between novice teachers' self-reported intentions to remain in teaching and actual retention or attrition rates is not entirely clear (Ingersoll & Strong, 2011). However, according to Ajzen's (1991) theory of planned behavior, intentions to perform behaviors are good predictors of actual behavior. Measures using teacher reports of future plans are likely to capture teachers' job satisfaction and commitment to the profession (Ingersoll & Strong, 2011). As Rosenholtz (1989) states, "commitment is generally viewed as the extent of work investment, performance quality, satisfaction, attention and *desire to remain in the profession*" (p. 422, italics added for emphasis). Recent research suggests that teachers' level of commitment to the profession may play a key role in their decision to remain in the field (Corbell, 2008; Corbell, Booth, & Reiman, 2010; Johnson & The Project on the Next Generation of Teachers, 2004). A longitudinal, qualitative study of fifty novice teachers found that teacher retention was affected by their commitment to the profession (Johnson & The Project on the Next Generation of Teachers, 2004). Those novice teachers who eventually left the profession previously had indicated their plans to remain in the field short-term, while those that stayed reported being happy to teach and foresaw a long future in the profession. Since the data for the present study are cross-sectional, I am prevented from measuring retention and attrition directly. Therefore, for the purpose of the present study, novice teacher's self-reported *intentions* to remain in the teaching profession serve as the basis for understanding their commitment to the occupation and are a proxy for novice teachers' likelihood of retention.

Preparation pathway and intentions to remain in teaching. Little research has been conducted on the relationship between preparation pathways and novice teachers' intentions

to remain in the profession. Many researchers have suggested that additional studies are needed to examine the relationship between career decisions and preparation pathways (Freedman & Appleman, 2009; Johnson, Berg, & Donaldson, 2005; Rosenberg, Boyer, Sindelar, & Misra, 2007). Much of the current research that has been conducted in this area involves longitudinal case studies of particular teacher education programs. While such studies provide opportunities to track graduates along their career paths and examine how components of specific education programs are related to teacher intentions and retention, the findings are limited to a small group of educators within a specific geographic region (Johnson et al., 2005), and therefore lack generalizability.

Results of a recent qualitative case-study investigation examined the contribution of a teacher education program to retention rates for teachers in high-poverty, urban school environments (Freedman & Appleman, 2009). Teachers who felt that they had substantive and coordinated preparation in both practice and theory perceived themselves to be better prepared to enter the workforce and were more likely to remain in the profession than their other first-year colleagues. A balance between learning teaching methods and strategies in classroom settings and participating in student teaching enabled teachers to make connections between how their educational knowledge applied to practice and how important it was to have the theory behind teaching (Freedman & Appleman, 2009). These findings suggest that teachers whose preparation pathway experiences incorporated both courses in teaching methods and strategies and applied training, such as internships, practica, or student teaching, are more likely to anticipate remaining in the profession than those whose backgrounds were not as connected.

A recent study by Klassen and Chiu (2011) examined the association between preservice (i.e., novice) teachers' confidence about teaching and their occupational commitment, or level of attachment, to the teaching profession. Results indicated that preservice teachers' occupational commitment was related to their self-efficacy for classroom management. Novice teachers were more likely to remain in the teaching profession when they felt confident about their ability to manage student behavior in the classroom (Klassen & Chiu, 2011). Findings from this study suggested that preparation pathways that focus on building teacher candidates' self-efficacy, particularly in the area of classroom management, may encourage novice teachers to intend on remaining in the profession, further emphasizing the importance of courses in teaching methods and strategies as an important indicator of perceptions of preparedness and intentions to remain in the teaching profession.

LaTurner (2002) researched the relationship between teacher preparation and commitment to teach on a nationally representative sample of middle and secondary math and science teachers. By focusing on variations in teacher certification and subject matter knowledge, LaTurner (2002) developed a better understanding of the qualifications and subsequent career intentions of novice STEM educators entering the field from these varying preparation pathways. In particular, he discovered that teachers with certification and least 18 hours of coursework in their subject area indicated a longer-term commitment to the profession more than any other group (e.g., STEM teachers who only had the minimum coursework hours but no certification or STEM teachers who only had certification but not the minimum number of coursework hours). LaTurner (2002) concluded that retention initiatives should be tailored to the individual's preparation pathway: "what may work to retain individuals in the teaching profession from one path may not work for another path"

(p. 654). For example, while teachers without certification (*subject-only teachers*) focused on income potential in determining whether or not to remain in the teaching profession, teachers with certification (*certification-only teachers*) emphasized the intrinsic reward of feeling like they were helping others as their motivation for being committed to the profession.

According to LaTurner (2002), the level of teacher preparation is an indicator of teacher quality and commitment and variations in STEM teacher qualifications may lead to different long-term intentions to remain in the teaching profession.

In a research study of the effects of teacher education and preparation on the retention rates of novice science and math teachers, Ingersoll and colleagues (2011) defined novice teachers who received a *comprehensive pedagogy* as those individuals who had taken five or more courses in teaching methods or teaching strategies and received the following preparation during their teacher candidate training: a full semester of practice teaching; preparation in how to select and adapt instructional materials; courses in learning theory and child psychology; opportunities to observe other's classroom teaching; and formal feedback on their own teaching. Results from this study revealed that first year science and math teachers who took five or more courses in teaching methods or strategies courses were three times less likely to leave the profession than those who took one or fewer courses in teaching strategies and methods, received little or no practice teaching or obtained little or few of the other four types of pedagogical preparation components listed above (Ingersoll, Merrill, & May, 2011). These findings suggest that elements of a comprehensive pedagogy, in particular the number of courses in teaching methods and strategies taken by STEM teacher candidates, may contribute to teacher retention. The present study includes many of these components as elements of a comprehensive preparation pathway.

Sandoval-Lucero and colleagues (2011) explored the first year experiences of novice teachers from varying preparation pathways to examine relationships between teacher candidates' preparation and their intentions to remain in the teaching profession. Comparing teachers from a traditional preparation program, a professional development masters' program, and a teacher-in-residence program, the researchers found that, regardless of the preparation pathway completed, the majority of novice teachers in this study planned to remain in the field long-term (Sandoval-Lucero et al., 2011). However, groups differed in their perceived long-term roles in the teaching profession. Those novice teachers trained in the traditional preparation program and masters' program were more likely to express an interest in administrative or leadership positions in the future (Sandoval-Lucero et al., 2011). Furthermore, these beginning teachers were likely to expect to attain additional schooling to further their careers. In contrast, individuals from teacher-in-residence program were the least likely to mention future career plans beyond their role as a teacher in the classroom and were the only group to report entering the teaching profession due to dissatisfaction with their previous careers (Sandoval-Lucero et al., 2011). These findings suggest that preparation pathways may contribute to teachers' long-term career objectives. Additionally, individuals' prior experiences and personal beliefs may be associated with their future professional plans. However, a small sample size limited the generalizability of the findings from this particular study.

Other research has demonstrated that school environments may play a significant role in teachers' intentions to remain in the profession (Johnson et al., 2005; Tamir, 2010). Previous studies have reported that teachers seek collaborative, challenging, and supportive work environments that provide opportunities for growth and increased responsibilities and

leadership over time (Johnson et al., 2005). Findings from these studies highlight the importance of programs, such as induction, on novice teachers' perceptions and intentions.

Induction programs and intentions to remain in teaching. One of the main goals of induction programs has been to reduce the rate of teacher turnover that results from a lack of support or guidance that novice teachers receive when entering the profession (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004). In order to improve teacher performance and student achievement, it is imperative to have long-term retention of teachers (Boyd et al., 2009; Darling-Hammond, 1999; Rockoff, 2004). Research has shown that student achievement increases as teachers gain three or more years of experience (Darling-Hammond, 1999; Rockoff, 2004). Teachers who stay in the field help to build positive child-teacher relationships and support systems for other teachers within the educational system (Darling-Hammond, 1999). When teachers stay in the field, they are also more likely to gain the strategies needed to perform effectively in their particular school environment (Rockoff, 2004). Over the past decade, several research studies have indicated that well-implemented induction programs successfully increase teacher retention (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004).

Using the 1999-2000 Schools and Staffing Survey (SASS) and the 2000-2001 Teacher Follow-Up Survey, Smith and Ingersoll (2004) conducted a study that examined the extent to which induction programs had a positive effect on the retention of beginning teachers. By comparing attrition rates of novice teachers who did and did not participate in induction programs, they found that novice teachers who participated in an induction program were less likely to leave the profession after their first year in the occupation than those who did not participate in an induction program (Smith & Ingersoll, 2004). During this

study, Smith and Ingersoll (2004) also examined various aspects of induction programs, and found certain induction activities to be more effective at reducing novice teacher turnover than others. Having ongoing guidance or feedback from a mentor and having common planning time with teachers, especially with those from the same field, were particularly effective. Smith and Ingersoll (2004) also noted that although certain components of induction did not have a significant impact on teacher turnover *individually*, induction program combinations were significantly associated with lower teacher attrition, *collectively*. The researchers concluded that teachers who participated in comprehensive induction programs had the lowest attrition rates among all teachers who participated in such programs (Smith & Ingersoll, 2004). Taken together, the findings from these studies reveal that mentoring and collaboration appear to be more effective than other induction activities at reducing turnover. Nevertheless, since findings also indicated that other components of induction programs have significant impacts on teacher turnover rates collectively, combinations of induction program activities may also contribute to greater retention rates.

More recently, studies of induction participation and teacher retention have focused on the *degree* to which novice teachers' participation in such programs is associated with their commitment to the profession (Ingersoll & Strong, 2011). Since 2004, rates of induction have become much more widespread. With more novice teachers receiving at least *some* type of guidance or support during their first year on the job, it is becoming more informative to assess the extent to which teachers received various components of induction programs and activities than it is to compare whether or not such services were provided at all (Ingersoll & Strong, 2011). The following literature demonstrates this shift in induction program research.

A recent meta-analysis conducted by Ingersoll and Strong (2011) examined the

overall effectiveness and impact of induction and mentoring programs on various teacher outcomes, including teacher retention. Findings from this meta-analysis showed that novice teachers who participated in a comprehensive induction program reported higher job satisfaction levels, greater commitment to the profession, and higher retention rates than teachers who participated in a weak induction program, or no induction program at all. Similarly, most studies demonstrated that those novice teachers who were highly engaged in their induction program established successful pedagogical skills and performed better on various aspects of teaching, such as classroom management skills and maintenance of a positive classroom environment, than novice teachers who were minimally engaged in their program. Finally, findings from some empirical research also demonstrated that students of novice teachers, who participated in induction programs, received increased scores and achievement gains on academic tests. Ingersoll and Strong (2011) concluded that the empirical research to date provides support that induction and mentoring programs have a positive impact on novice teacher outcomes, including job commitment, pedagogical skills, and increasing student achievement.

Although previous research (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004) has added crucial knowledge to the literature regarding induction programs and teacher retention, among other outcomes, these prior analyses nevertheless also identified significant gaps in the literature extant. Specifically, there remains a lack of understanding regarding the extent to which induction and mentoring programs are helpful for new teachers regardless of the strength or quality of their preparation pathway (Ingersoll & Strong, 2011). In the present study, I attempt to examine these gaps and further add to the research literature by investigating how the relationship between the comprehensiveness of novice teachers'

preparation pathways and induction programs affects their perceptions of preparedness and intentions to remain in teaching.

Relationship between Preparation Pathway Comprehensiveness and Induction

Program Comprehensiveness on Teacher Outcomes

Previous research has demonstrated that the type of preparation pathway obtained may not be as important as the quality of the support and guidance systems received through induction (Duke, Karson, & Wheeler, 2006; Unruh & Holt, 2010). This suggests that the comprehensiveness of novice teachers' induction programs may moderate the relationship between their preparation pathway and perceptions of preparedness as well as intentions to remain in the profession. The following research studies reveal the importance of examining novice teachers' perceptions and intentions in the context of both their preparation pathway *and* induction program together.

Unruh and Holt (2010) examined the kinds of support that alternative-entry and traditional-entry teachers found most helpful in their induction programs. Results of data analyses from the Center for the Support of Beginning Teachers' 2007-2008 Beginning Teacher Survey suggested that alternative-entry teachers had strong subject matter competency but poor instructional strategies and classroom management skills, as compared to traditional-entry teachers (Unruh & Holt, 2010). Therefore, induction programs that focused on enhancing those classroom and instructional skills were most beneficial for alternative-entry novice teachers. By comparison, traditional-entry teachers benefited from induction programs that focused on collaboration with peers and learning from mentors, components of support that they were accustomed to receiving during their teacher education program. Although each group of novice teachers benefited from different induction services,

the researchers did not find the type of preparation pathway to be a significant factor in participants' sense of self-efficacy. This finding suggests that the *type* of preparation pathway may not be as important in determining novices' perceptions of preparedness, but rather, that the components of the induction program may strongly influence the benefits and skills new teachers perceive to acquire through such support and guidance systems.

Using the 1999-2000 Schools and Staffing Survey, Duke and colleagues (2006) examined the extent to which mentoring and induction programs benefit novice teachers with weak preservice education and training preparation. They found that novice teachers who received guidance from a mentor or participated in an induction program during their first year of teaching demonstrated a greater commitment to the profession than novice teachers who did not receive these supports. Furthermore, the positive effect of induction and mentoring was greater for novice teachers without a bachelor's degree in education, considered "weak" preservice education by the researchers, than for novice teachers with a bachelor's degree in education. The researchers determined that participation in an induction program increased the probability that a teacher without a bachelor's degree in education would plan to remain in the profession long-term by nine percentage points (Duke, Karson, & Wheeler, 2006). Taken together, these results suggest that the relationship between novice teachers' preparation pathway comprehensiveness and their intentions to remain in the teaching profession may be moderated, or depend upon, their participation in an induction program. Participation in an induction program may compensate for obtaining a weak preparation pathway (e.g., bachelor's degree not in education) such that novice teachers who participated in an induction program but received weak education preparation may be more likely to intend to remain in the teaching profession long-term than novice teachers who

received a strong preparation (e.g., bachelor's degree in education) but did not participate in an induction program.

The researchers also examined the extent to which individual components (e.g., common planning time, communication with a principal, etc.) of induction programs resulted in positive effects on novice teachers' commitment to the teaching profession, revealing mixed findings. While a model that estimated the interaction between collaborative planning time and education degree demonstrated greater positive effects on commitment to teaching for those individuals *without* an education degree, another model that estimated the interaction between supportive communication from a principal and education degree demonstrated greater positive effects on commitment to teaching for individuals *with* an education degree. However, only a small margin of the total models that they tested revealed significant results. Duke and colleagues (2006) concluded that these conflicting findings prevented them from making strong determinations about the individual effects of mentoring and induction on novice teachers' commitment to teaching. In the present study, I expanded upon Duke and colleagues' (2006) examination of the effects of induction programs on novice teachers' commitment to the teaching profession in relation to their preparation. Unlike their study, however, I assessed the comprehensiveness of novice teachers' induction programs overall, rather than by each component. Furthermore, I investigated a combination of components from novice teachers' education and training (e.g., coursework, practice teaching experience, certification type, etc.), rather than a single factor, in order to more fully understand the possible moderating relationship between novice teachers' induction program and preparation pathway comprehensiveness, and outcome variables of perceptions of preparedness to teach and intentions to remain in the profession long-term.

CHAPTER 4

THE PRESENT STUDY

Variations in novice teachers' preparation pathways and induction program experiences are likely to be associated with how teachers perceive their level of preparedness when entering the profession and are likely to be related to teachers' intentions to remain in the profession long-term. However, gaps in the research still exist in understanding the extent to which induction and mentoring programs are helpful for new teachers regardless of the strength or quality of their preparation pathway. Likewise, further attention is needed to understand the relationship between these variables for novice teachers in the critical STEM fields. In the current study, I explore associations among these diverse factors in order to understand how they relate to perceptions of preparedness and retention for middle and secondary novice STEM teachers across the United States, specifically:

- HYP1: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and their perceptions of preparedness. Novice STEM teachers who received a more comprehensive preparation pathway will report more favorable perceptions of preparedness to teach than novice STEM teachers who received a less comprehensive preparation pathway.
- HYP2: I hypothesize that, after accounting for the effects of teacher background

characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' induction programs and their perceptions of preparedness. Novice STEM teachers who participated in a more comprehensive induction program will report more favorable perceptions of preparedness to teach than novice STEM teachers who participated in a less comprehensive induction program.

- HYP3: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), the comprehensiveness of middle and secondary novice STEM teachers' induction programs will moderate the relationship between preparation pathway comprehensiveness and perceptions of preparedness. The positive effects of participating in a comprehensive induction program on perceptions of preparedness will be greater for middle and secondary novice STEM teachers who received a less comprehensive preparation pathway.
- HYP4: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and their intentions to remain in the teaching profession. Novice STEM teachers who received a more comprehensive preparation pathway will be more likely to plan to remain in the teaching profession long-term, compared to novice STEM teachers who received a less comprehensive preparation pathway.

- HYP5: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' induction programs and their intentions to remain in the teaching profession. Novice STEM teachers who participated in a more comprehensive induction program will be more likely to plan to remain in the teaching profession long-term, compared to novice STEM teachers who participated in a less comprehensive induction program.
- HYP6: I hypothesize that after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), the comprehensiveness of middle and secondary novice STEM teachers' induction program will moderate the relationship between preparation pathway comprehensiveness and intentions to remain in the teaching profession. The positive effects of participating in a comprehensive induction program on intentions to remain in the teaching profession will be greater for middle and secondary novice STEM teachers who received a less comprehensive preparation pathway.

CHAPTER 5

METHODS

This study utilized The Schools and Staffing Survey (SASS) conducted by the U.S. Department of Education's National Center for Education Statistics (NCES). SASS was developed to obtain information on a nationally representative sample of schools, administrators, teachers, and students in both public and private institutions. The SASS teacher questionnaire, in particular, was designed to measure teacher education and training, certification, workload, and perceptions and attitudes about teaching (U.S. Department of Education, 2008). Of particular interest to the current study were data on teachers' characteristics, including teacher education and training, perceptions about teaching, and attrition and retention intentions.

Participants

The full SASS teacher questionnaire included a sample of 38,240 teachers. In order to narrow the dataset, I proceeded to filter those teachers who did not meet the criteria for the present study. In the first step, I excluded all educators who did not teach on a regular, full-time basis. This eliminated itinerant, substitute, and part-time teachers, reducing the sample size to 34,870. In the second step of the filtering process, I excluded those teachers who began teaching before the 2005-2006 school year. As defined in the present study, novice teachers are those educators with three or fewer years of teaching experience. By this definition, only those educators who began teaching on or after the 2005-2006 school year were considered novices at the time of the SASS survey distribution. Results of this process

led to a sample size of 5,570 participants. Next, I eliminated those educators who did not teach at the secondary level, grades six through 12. This excluded teachers who instructed Pre-Kindergarten through fifth grades, and led to a sample size of 3,600 individuals. Finally, I restricted the sample to only educators who were teaching science, technology, engineering, or mathematics (STEM) courses as their primary assignment. Results of the total filtering process created a study sample of 1,080 individuals, 3% of the original dataset. In order to avoid reporting individually identifiable information about the study sample, all sample sizes and degrees of freedom reported in this study were rounded to the nearest tenth, as per NCES clearance regulations (U.S. Department of Education, 2010).

Demographic information was also described for the sample, including: age, gender, race/ethnicity, number of years of teaching experience, and number of grade levels taught. Table 1 demonstrates the means, standard deviations, and majority percentages for the teacher control variables.

Table 1

Means, Standard Deviations, and Percentages for Teacher Control Variables (N = 1080)

Variable	<i>M</i>	<i>SD</i>	% ^a
Age	30.07	8.55	
Gender			63% Female (<i>N</i> = 680)
Race			88% White (<i>N</i> = 940)
Ethnicity			96% Not Hispanic/Latino (<i>N</i> = 1030)
NYT	1.96	0.80	
GLT			64% 9th – 12 th grade (<i>N</i> = 690)
NGT	2.91	1.29	

Note. NYT = number of years of teaching experience; GLT = grade level taught; NGT = number of grades taught.

^a *N* rounded to the nearest 10th as per NCES regulations.

Review of the teacher control variables revealed abnormalities in the distribution of the data. Eighty-five percent of teachers in the current study ranged in age from 20 – 40 years old. The racial and ethnic composition of the sample was also severely skewed with the largest percentage of participants identifying as white, non-Hispanic or Latino. Additionally, the majority of teachers in the study sample taught more than one grade level as a full-time teacher with 64% of educators teaching three or more grades in a given year. On the other hand, novice teachers' number of years of teaching experience was more normally distributed with approximately one-third of participants currently teaching in their first year at the time they took the survey.

Procedures

The U.S. Census Bureau has administered the SASS on six occasions starting from the 1987-1988 school year until the 2007-2008 school year, most recently (U.S. Department of Education, 2008). Of particular interest to the current study was the 2007-2008 SASS, which consisted of 10 different types of questionnaires (see Appendix A for the full list of questionnaires). Of the 10 questionnaires, I used the 2007-2008 SASS Public School Teacher Questionnaire for the present study. The Public School Teacher questionnaire was designed to obtain information about regular full-time and regular part-time teachers as well as itinerant teachers, who were assigned to provide instruction at more than one school, and long-term substitute teachers, who were assigned to fill the role of a regular teacher on a long-term basis (U.S. Department of Education, 2008).

The U.S. Census Bureau administered the 2007 -2008 SASS using a mail-based survey procedure. During the summer of 2007, the Census Bureau sent an advance letter to sampled schools seeking verification of school names and addresses. Subsequently, a packet

containing all surveys and pertinent explanatory information was sent to each school. Telephone calls, assisted by a computer-based interviewing instrument, were conducted to establish a survey coordinator at each of the sampled schools. Questionnaires were distributed to teachers through a flow system during the fall of 2007 and spring of 2008.

While participation in the survey was voluntary, individuals were encouraged to participate, and telephone and field follow-ups were conducted in order to increase response rates. Throughout the course of the year, the survey coordinator at each school was contacted, via telephone, to remind teachers to complete and return the survey forms. The Census Bureau also followed up with individual respondents, via telephone, to assist in finishing incomplete surveys. Finally, field follow-ups were conducted for any school or individual who did not return a questionnaire. Overall, the response rate of public school teachers in the survey was 72.4% (U.S. Department of Education, 2008).

Measures

The following section specifies how the study's predictor and outcome measures were defined and identifies how the criteria for these variables were selected from the 2007-2008 Public School Teacher questionnaire. It is important to note that the question prompts for the predictor variable, *induction program comprehensiveness*, and the outcome variable, *perceptions of preparedness*, asked teachers to respond based on their experiences and perceptions during their *first year* as an educator. For these questions, teachers who were currently in their first year of teaching were asked to answer based on the current school year, while those teachers who were not teaching in their first year were requested to think back to their first year of teaching in order to respond (U.S. Department of Education, 2008). The section begins with an overview of the predictor variables before specifying the outcome

variables.

Preparation pathway. Preparation pathway was defined as the education and training route taken to prepare individuals for the responsibilities of the teaching profession. Of particular interest in the current study were individuals' completion of specific components within that pathway that, when examined as an amalgam, represented a comprehensive preparation. Based on the literature available (e.g., Darling-Hammond, Chung, et al., 2002; Freedman & Appleman, 2009; Imbimbo & Silvernail, 1999), I characterized the comprehensiveness of participants' preparation pathways based on completion of: (a) five or more college or graduate level courses on teaching methods or strategies; (b) student or practice teaching experience that lasted twelve weeks or longer; (c) full state certification; and (d) a demonstrated competency in subject area taught, as indicated by a match between the novice teacher's certification area and subject area taught.

In the present study, preparation pathway comprehensiveness was operationalized as a count of the number of components, characterized above, that novice teachers completed during their education and pre-service training. Successful completion of a greater number of components implied completion of a more comprehensive preparation pathway. Composite scores for this continuous variable ranged from zero to four. A score of four indicated completion of a *comprehensive preparation pathway*, demonstrating that an individual completed all four preparation pathway components that characterized a comprehensive education and training. A score of zero indicated completion of an *incomprehensive preparation pathway*, demonstrating that an individual did not complete any of the four preparation pathway components that characterized a comprehensive education and training. The subsequent question prompts and response options indicate how the criteria for the

comprehensiveness of an individual's preparation pathway were measured from the 2007-2008 Public School Teacher questionnaire. A table representing the survey questions, original response options, and recoded response options for the *preparation pathway comprehensiveness* variable is presented in Appendix B.

The first question prompt examined the courses taken during an individual's education. It stated, "Have you ever taken any graduate or undergraduate courses that focused on teaching methods or teaching strategies"? Survey participants were prompted to respond "Yes" or "No". Those participants who responded *no* were requested to move on to the next survey question. Those participants who responded *yes* were asked the following sub-question prompt: "How many courses"? Response options for this question were: "(a) 1 or 2 courses, (b) 3 or 4 courses, (c) 5 to 9 courses, and (d) 10 or more courses". According to literature by Ingersoll and colleagues (2011), novice STEM teachers who completed five or more courses in teaching methods or strategies were considered to have completed a comprehensive pedagogy and were more likely to stay in the profession than those who took one or less courses in teaching methods and strategies. Therefore, for the purpose of the present study, those participants who completed five or more courses in teaching methods or strategies were recoded to 1 and those who completed four or fewer courses were recoded to 0.

The second question prompt examined the length of time individuals participated in practice teaching. Survey participants were asked the following question: "How long did your practice teaching last"? Participants were asked to mark only one box when they selected from these options: "(a) I had no practice teaching, (b) 4 weeks or less, (c) 5-7 weeks, (d) 8-11 weeks, or (e) 12 weeks or more". According to professional standards set

forth by the National Council for Accreditation of Teacher Education, teacher candidates are expected to participate in field experiences that are “sufficiently extensive and intensive for candidates to demonstrate competence in the professional roles for which they are preparing” (National Council for Accreditation of Teacher Education, 2008, p. 30). The National Council on Teacher Quality further specifies these standards by suggesting that such field experiences should be a minimum of ten weeks in length (National Council on Teacher Quality, 2011). Due to the distribution of response options on the questionnaire, I was prevented from distinguishing whether or not a participant who marked option (*d*) received more or less than ten weeks of practice teaching experience. Therefore, I used option (*e*) *12 weeks or more* as the cut point for this particular variable. In order to measure the strength or weakness of an individual’s practice teaching experience, item responses *a*, *b*, *c*, and *d* were combined to represent weak practice teaching, and response *e* represented strong practice teaching. These variables were recoded so that 1 represented strong practice teaching and 0 represented weak practice teaching.

In order to measure state certification, participants were queried: “Which of the following describes the teaching certificate you currently hold in THIS state”? Response options were as follows: “(a) Regular or standard state certification or advanced professional certificate (b) Certificate issued after satisfying all requirements except the completion of a probationary period (c) Certificate that requires some additional coursework, student teaching, or passage of a test before regular certification can be obtained (d) Certificate issued to persons who must complete a certification program in order to continue teaching or (e) I do not hold any of the above certifications in THIS state”. In order to measure the strength of one’s certification, response *a*, indicating a regular, full state certification, was

recoded to 1 and responses *b* through *e*, indicating partial or no state certification, was recoded to 0.

The final indication of the comprehensiveness of an individual's preparation pathway examined novices' subject matter competency. For the purpose of this study, subject matter competency was operationalized by identifying novices' certification code(s), by content area, and matching it to their teaching assignment code(s), by subject matter. Participants responded to questions about the content areas and grade ranges in which they were certified. Those participants who responded *a* through *d* on the state certification question were directed to this section; those who responded *e* on the state certification question, indicating that they did not hold a certification in the state they were teaching, were requested to go to a different item. The state certification query was, "(1) Using Table 3 on page 18, in what content area(s) does the teaching certificate marked above allow you to teach in THIS state". For this question, the response option required survey participants to look up certification content area codes and write in the code number along with the corresponding content area description. The list of certification content area codes and their matching STEM-related field areas are illustrated in Appendix C. If a certificate allowed an individual to teach in more than one content area, survey participants were able to report additional content areas in parts C through J (U.S. Department of Education, 2008).

Subject taught was measured by participants' responses to the question, "This school year, what is your MAIN teaching assignment field at THIS school"? According to the Public School Teacher questionnaire, *main assignment* was defined as the field in which an individual taught the most classes (U.S. Department of Education, 2008). For this question, the response option required survey participants to look up teaching assignment and subject

matter codes and write in the code number along with the corresponding subject area description. The list of teaching assignment codes and their matching STEM-related subject areas are illustrated in Appendix D. In the current study, a match between the subject-matter code and the certification content area code was recoded to 1. A mismatch between a novice's content area certification and main teaching assignment subject was recoded to 0. Table 2 lists the certification content area codes and their corresponding matching teaching assignment field codes.

Induction program. Induction programs were defined as support, guidance, and orientation programs for novice teachers (Smith & Ingersoll, 2004). Of particular interest in the current study were individuals' exposure to certain experiences that, when examined as a composite, represented a comprehensive guidance and support service for novice teachers. Based on the literature available (e.g., Andrews & Quinn, 2005; Ingersoll & Strong, 2011; Smith & Ingersoll, 2004), I characterized the comprehensiveness of participants' induction programs based on receiving guidance from a mentor as well as individuals' participation in the following experiences: (a) a reduced teaching schedule or number of preparations, (b) common planning time with teachers in the same subject area, (c) seminars or classes for beginning teachers, (d) extra classroom assistance, such as teacher aides, and (e) supportive communication with principals, other administrators, or the department chair.

In the present study, induction program comprehensiveness was operationalized as a count of the number of experiences, characterized above, that novice teachers participated in that provided them with support and guidance. Participation in a greater number of experiences implied completion of a more comprehensive induction program. Composite scores for this continuous variable ranged from zero to six. A score of six indicated

participation in a *comprehensive induction program*, demonstrating that an individual received guidance or feedback from a mentor and participated in all five additional induction experiences. A score of zero indicated an *incomprehensive induction program*, demonstrating that an individual did not receive guidance or feedback from a mentor or did not participate in any of the five additional induction experiences. It is important to note that an induction program that contained any or all of the above experiences but failed to contain guidance from a mentor was classified as an incomprehensive induction program because of the absence of the crucial mentoring element that researchers (e.g., Andrews & Quinn, 2005; Ingersoll & Strong, 2011; Smith & Ingersoll, 2004) have found to be correlated with the outcome variables of interest in this study. The subsequent question prompt and response options indicate how the criteria for comprehensiveness of an individual's induction program were measured from the 2007-2008 Public School Teacher questionnaire.

The question prompt for the induction program variable asked participants the following question: "Did you receive the following kinds of support during your FIRST year of teaching"? Respondents were requested to answer "Yes" or "No" for each of the following subsections: "(a) reduced teaching schedule or number of preparations, (b) common planning time with teachers in your subject, (c) seminars or classes for beginning teachers, (d) extra classroom assistance, such as teacher aides, (e) supportive communication with your principal, other administrators, or department chair, and (f) ongoing guidance or feedback from a master or mentor teacher". For each of the above subsections, a response of *yes* was recoded to 1 while a response of *no* was recoded to 0. Each response that was recoded to 1 contributed to the composite score representing the comprehensiveness of novice teachers' induction programs.

Table 2

Certification Content Area Codes and Matching Teaching Assignment Field Codes

Certification content area code	Teaching assignment field code
MATHEMATICS	
190 = Mathematics	191 = Algebra I 192 = Algebra II 193 = Algebra III 194 = Basic and general mathematics 195 = Business and applied math 196 = Calculus and pre-calculus 198 = Geometry 199 = Pre-algebra 200 = Statistics and probability 201 = Trigonometry
197 = Computer science	197 = Computer science
NATURAL SCIENCES	
210 = Science, general	210 = Science, general
211 = Biology or life sciences	211 = Biology or life sciences
212 = Chemistry	212 = Chemistry
213 = Earth sciences	213 = Earth sciences
210 = Science, general 211 = Biology or life sciences 212 = Chemistry 213 = Earth sciences 216 = Physical sciences 217 = Physics 218 = Other natural sciences	215 = Integrated science
216 = Physical sciences	216 = Physical sciences
217 = Physics	217 = Physics
218 = Other natural sciences	210 = Science, general 211 = Biology or life sciences 212 = Chemistry 213 = Earth sciences 215 = Integrated science 216 = Physical sciences 217 = Physics

Perceptions of preparedness. Perceptions of preparedness were measured through a survey query that examined how well prepared novice teachers felt to teach in five categories. The question prompt stated, “In your FIRST year of teaching, how well prepared were you to: (a) Handle a range of classroom management or discipline situations, (b) Use a variety of instructional methods, (c) Teach your subject matter, (d) Use computers in classroom instruction, (e) Assess students, and (f) Select and adapt curriculum and instructional materials”. The use of the prompt (d) *use computers in classroom instruction* was excluded from the present study for its lack of relevance to the current research questions. Teachers who were currently in their first year of teaching were asked to answer based on the current school year (U.S. Department of Education, 2008). Those teachers who were not teaching in their first year were requested to think back to their first year of teaching in order to respond. Response options for the perceptions of preparedness variable were as follows: “(1) Not at all prepared; (2) Somewhat prepared; (3) Well prepared; (4) Very well prepared.” (U.S. Department of Education, 2008). Participants were asked to mark only one box per question category.

For the present study, scores from each question category were averaged to create a composite score for each participant. Composite scores ranged from one to four. A score of one indicated that the respondent did not feel at all prepared in any of the five categories, as denoted by a score of one for each individual category. A score of four indicated that the respondent felt very well prepared in all five categories, as denoted by a score of four in each individual category. Internal consistency reliability was measured for this scale in order to determine the degree to which the items were related to each other. Reliability for this scale

was 0.80, $p = 0.01$, indicating that the items interrelated well enough to add them together into a composite variable.

Intentions to remain in the teaching profession. Intentions to remain in the teaching profession were characterized by examining how long novice teachers planned to continue teaching. Survey participants were asked, “How long do you plan to remain in teaching”? Respondents were requested to mark only one answer from the following eight response options: “(a) As long as I am able, (b) Until I am eligible for retirement benefits from this job, (c) Until I am eligible for retirement benefits from a previous job, (d) Until I am eligible for Social Security benefits, (e) Until a specific life event occurs (e.g., parenthood, marriage), (f) Until a more desirable job opportunity comes along, (g) Definitely plan to leave as soon as I can, or (h) Undecided at this time”.

In order to measure novice teachers’ intentions to remain in the profession, responses *a* through *d* were categorized as *long-term*, indicating that an individual was committed to remaining in the profession for a significant portion of his or her career. Responses *e* through *h*, indicated that an individual intended to leave the profession before the full length of his or her career was complete, and were categorized as *not long-term*. Responses indicating *long-term* intentions were dummy coded with 1, while responses indicating *not long-term* intentions were dummy coded with 0.

Ethical and Security Considerations

Protection of identifiable data. There are two types of SASS datasets available from NCES: the public-use dataset and the restricted-use dataset. The public-use dataset is universally available to interested individuals via the NCES website (U.S. Department of Education, 2008) and omits or condenses variables that contain identifiable district, school,

administrator, and teacher information. The restricted-use dataset, on the other hand, contains all participant responses and does not exclude or condense variables. This dataset is only available to authorized users who have signed the affidavit of non-disclosure, as it has the potential of containing identifiable information.

Currently, only the 1999-2000 SASS is available as public-use datasets. Since the current research focused on the most recent trends in teacher preparation pathways, induction programs, perceptions of preparedness and teacher intentions to remain in the profession, it was most appropriate to utilize the 2007-2008 SASS restricted-use dataset. In addition, the public-use dataset limited the components of preparation pathway information that could be attained from the Public School Teacher questionnaire. In order to enrich my analyses and provide a comprehensive examination, it was most beneficial to have access to all of the preparation pathway variables.

In accordance with the terms and conditions of the restricted license agreement with the Institute of Education Sciences (IES), multiple security measures were enacted to protect the data and respondents' identities. A fully enclosed and restricted-access office space was designated as the secure data room. Only authorized users, who signed an affidavit of non-disclosure and were approved as licensees on the project by IES, were provided access to this locked office. Additional security measures were also taken to ensure that the computer containing the restricted dataset remained protected. The computer containing the restricted-use dataset was password protected and did not have any access to the Internet, local area networks (LANs), servers, or any other electronic networking devices. Furthermore, this standalone, desktop-model computer also contained a display warning indicating to users that

it was a restricted-use machine and automatically returned to a password-protected screen saver after ten minutes of computer inactivity.

Hardcopy printouts of the restricted-use data, as well as the original CD-ROM containing the data, were stored in a locked cabinet within the secure data room. Backup copies of the restricted-use data were not permitted. Only copies of SPSS syntax files were permitted in order to enable the researcher to recreate analytic data files, if needed, due to computer failure.

Prior to the removal of any data results, tables, presentations, or draft documents from the secure data room, a disclosure review was required to ensure that the release of confidential information was prevented. Permission to provide documents or data results to unauthorized persons was permitted only after completion of the disclosure review by IES.

CHAPTER 6

PLAN OF ANALYSES

Descriptive statistics were used to describe the characteristics of the sample population. Univariate statistics including means, standard deviations, and percentages, as well as bivariate statistics including correlations, provided information about the relevant variables. Correlation coefficients were calculated among the control variables and between the control, predictor, and outcome variables.

The primary goal of this study was to examine the relationships of novice teachers' preparation pathways and induction programs to their perceptions of preparedness to teach and their intentions to remain in the teaching profession. In order to more fully understand these associations, two separate regression analyses were conducted to test the six main hypotheses. To test hypotheses one, two, and three, a hierarchical linear regression analysis was conducted to estimate the relationships between the two main predictor variables and the outcome variable, *perceptions of preparedness to teach*. This regression model was selected due to the continuous nature of the perceptions of preparedness variable. To test hypotheses four, five, and six, a binary logistic regression analysis was conducted to estimate the relationships between the two main predictor variables and the outcome variable, *intentions to remain in the teaching profession*. This regression model was selected due to the dichotomous nature of the intentions to remain in the teaching profession variable.

In the first step of the hierarchical linear regression model, I included all of the control variables. This model demonstrated how much of the variance of novice teachers'

perceptions of preparedness was explained by the control variables alone. In the second step of the hierarchical linear regression model, I included the predictor variables and examined R^2 change to determine how much of the variance in novice teachers' perceptions of preparedness was explained by the comprehensiveness of both their preparation pathway and induction program, after accounting for the control variables. A significant R^2 change indicated that the main variables of interest in this study collectively increased the amount of variance accounted for in the model. After a significant R^2 change was found, further examination of the relationship between each predictor variable on *perceptions of preparedness* was conducted through an interpretation of the regression coefficients. A significant, positive regression coefficient, β , demonstrated that the predictor variable of interest (i.e., preparation pathway comprehensiveness, induction program comprehensiveness) was a significant predictor of novice teachers' perceptions of preparedness to teach. These results provided the information needed to determine hypotheses one and two, respectively.

In the third step of the hierarchical linear regression model I examined the moderating effects of the comprehensiveness of teachers' induction programs on the relationship between preparation pathway comprehensiveness and perceptions of preparedness. The value of R^2 change determined how much of the variance in novice teachers' perceptions of preparedness was explained by an interaction between their preparation pathways and induction programs, after accounting for the control and individual predictor variables. Since no significant R^2 change was found, further examination of the relationship between the interaction term and novice teachers' *perceptions of preparedness* was not conducted through an interpretation of the regression coefficient. These results provided the information needed

to determine hypothesis three. The level of significance was set at 0.05 for all analyses.

The procedures I followed for testing hypotheses four through six were similar to those outlined for hypotheses one through three, with the exception that I estimated a logistic regression model. In the first step of the binary logistic model, I examined the overall variability in the data to determine how well the model that contains no predictor variables fit the data. A significant χ^2 in this step indicated that this baseline model was a significant departure from a good fit, as was expected with no predictor variables. Next, I added the control variables in order to determine their contribution to the fit of the model. Then, I added the predictor variables and evaluated the fit of the overall model by examining the significance of the χ^2 statistic with the predictor variables in the model and observing the value of the pseudo- R^2 statistic. A significant χ^2 in this step demonstrated that inclusion of the main predictor variables resulted in an improved fit of the model. I also saw the value of the χ^2 model with the predictors decrease in comparison to the value of the χ^2 model without the predictors, indicating that a model with predictors was a better fit than a model without any predictors. The pseudo- R^2 value, ranging on a scale of zero to one, indicated how much the inclusion of the predictor variables reduced the variation in the model (Menard, 2010). The closer the value was to one, the better the model with the included variables predicted novice teachers' intentions to remain in the teaching profession.

After a significant χ^2 was found, further examinations of the relationship between each individual predictor variable on the outcome variable, *intentions to remain in teaching*, were conducted through an examination of the Wald χ^2 statistic and odds ratio (*OR*). A significant Wald χ^2 statistic demonstrated that the predictor variable of interest (i.e., preparation pathway comprehensiveness, induction program comprehensiveness) was a

significant predictor of novice teachers' intentions to remain in the teaching profession. Likewise, examining the value of the odds ratio demonstrated the strength of the association between the individual predictor variable and the outcome, *intentions to remain in the teaching profession*. The value of the odds ratio indicated the likelihood that an individual planned to remain in teaching long-term as the predictor variable became more comprehensive (Newsom, 2011). These results provided the information needed to determine hypotheses four and five, respectively.

In the final step of the binary logistic regression model, I examined the moderating effects of the comprehensiveness of teachers' induction programs on the relationship between preparation pathway comprehensiveness and intentions to remain in the teaching profession. A significant χ^2 that was lower in value than the χ^2 model with the predictors only indicated that inclusion of the interaction term resulted in an improved fit of the overall binary logistic model. However, since a significant χ^2 was not found, I did not examine the Wald χ^2 statistic and odds ratio (*OR*) further. These results provided the information needed to determine hypothesis six. The level of significance was set at 0.05 for all analyses. Below, each of the hypotheses is restated followed by a brief description of the expected results.

- *HYP1: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and their perceptions of preparedness. Novice STEM teachers who received a more comprehensive preparation pathway will report more favorable perceptions of preparedness to teach than novice STEM teachers who received a less comprehensive*

preparation pathway. Given a significant increase in the variance accounted for by inclusion of the two predictor variables into the linear regression model, a positive and significant regression coefficient, β , indicates that middle and secondary novice STEM teachers' perceptions of preparedness to teach become more favorable as their preparation pathways become more comprehensive.

- *HYP2: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' induction programs and their perceptions of preparedness. Novice STEM teachers who participated in a more comprehensive induction program will report more favorable perceptions of preparedness to teach than novice STEM teachers who participated in a less comprehensive induction program.* Given a significant increase in the variance accounted for by inclusion of the two predictor variables into the linear regression model, a positive and significant regression coefficient, β , indicates that middle and secondary novice STEM teachers' perceptions of preparedness to teach become more favorable as their induction programs become more comprehensive.
- *HYP3: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), the comprehensiveness of middle and secondary novice STEM teachers' induction programs will moderate the relationship between preparation pathway comprehensiveness and perceptions of preparedness. The positive effects of participating in a comprehensive induction program on perceptions of preparedness will be greater for*

middle and secondary novice STEM teachers who received a less comprehensive preparation pathway. Given a significant increase in the variance accounted for by inclusion of the interaction term into the linear regression model, a positive and significant regression coefficient, β , indicates that the comprehensiveness of novice STEM teachers' induction programs moderates the relationship between preparation pathway comprehensiveness and perceptions of preparedness.

- *HYP4: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' preparation pathways and their intentions to remain in the teaching profession. Novice STEM teachers who received a more comprehensive preparation pathway will be more likely to plan to remain in the teaching profession long-term, compared to novice STEM teachers who received a less comprehensive preparation pathway. Given a significant χ^2 statistic and pseudo- R^2 value indicating an improved fit of the model following the inclusion of the two predictor variables, a significant Wald χ^2 statistic and a positive odds ratio (OR) greater than one indicates that middle and secondary novice STEM teachers' preparation pathway comprehensiveness is a meaningful and significant predictor of their intentions to remain in the teaching profession. As the comprehensiveness of novice teachers' preparation pathways increase, the probability that they plan to remain in the teaching profession long-term also tends to increase.*
- *HYP5: I hypothesize that, after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades*

taught), there will be a significant and positive relationship between the comprehensiveness of middle and secondary novice STEM teachers' induction programs and their intentions to remain in the teaching profession. Novice STEM teachers who participated in a more comprehensive induction program will be more likely to plan to remain in the teaching profession long-term, compared to novice STEM teachers who participated in a less comprehensive induction program. Given a significant χ^2 statistic and pseudo-R² value indicating an improved fit of the model following the inclusion of the two predictor variables, a significant Wald χ^2 statistic and a positive odds ratio (OR) greater than one indicates that novice STEM teachers' induction program comprehensiveness is a meaningful and significant predictor of their intentions to remain in the teaching profession. As the comprehensiveness of novice teachers' induction programs increase, the probability that they plan remain in the teaching profession long-term also tends to increase.

- *HYP6: I hypothesize that after accounting for the effects of teacher background characteristics (e.g., gender, age, race/ethnicity, teaching experience, number of grades taught), the comprehensiveness of middle and secondary novice STEM teachers' induction program will moderate the relationship between preparation pathway comprehensiveness and intentions to remain in the teaching profession. The positive effects of participating in a comprehensive induction program on intentions to remain in the teaching profession will be greater for middle and secondary novice STEM teachers who received a less comprehensive preparation pathway. Given a significant χ^2 statistic and pseudo-R² value indicating an improved fit of the model following the inclusion of the interaction term, a significant Wald χ^2 statistic and a positive odds ratio (OR) greater*

than one for the interaction term indicates that the comprehensiveness of novice STEM teachers' induction programs moderates the relationship between preparation pathway comprehensiveness and intentions to remain in the teaching profession.

CHAPTER 7

RESULTS

The following section describes the findings of the current study. First, I report the results of the correlational analyses calculated among the teacher control variables and between the control, predictor, and outcome variables. Next, I state the findings from the hierarchical linear regression analyses. I conclude with the results of the binary logistic regression analyses.

Correlational Analyses

Data were analyzed using IBM SPSS Statistics version 20. Any missing data had been previously filtered out by NCES prior to data analyses so that only valid entries remained in the restricted-use dataset used by the researcher. Correlations coefficients were calculated among the teacher control variables as well as between the control variables and the main predictor and outcome variables in the study. Pearson's r correlation coefficients were calculated to estimate relationships between two continuous variables, for instance the relationship between novice teachers' age and number of years of teaching experience. Likewise, point-biserial correlations coefficients were calculated to estimate relationships between continuous and categorical variables (i.e., *age vs. gender; age vs. intentions to remain in the teaching profession*).

SPSS does not have a special procedure for a point-biserial correlation analysis. Rather, the point-biserial correlation is considered a special case of the Pearson's r correlation. When a Pearson's r correlation is calculated for a relationship between a

continuous and dichotomous categorical variable, the coefficients produced are considered point-biserial correlations (IBM, 2010). Therefore, the procedure for Pearson's r was used during data analysis for *all* correlations calculated. Pearson's Chi-square test of independence was conducted to examine relationships between two categorical variables, in particular, the control variables *gender*, *ethnicity*, and *race*, and the outcome variable, *intentions to remain in the teaching profession*.

Table 3 presents the correlation matrix among the teacher control variables. Although a few of the control variables were significantly related to one another, the strength of the correlation was weak. This indicated that the size of the sample may have contributed to the presence of significant findings. Since no substantial relationships were evident among the teacher control variables, multicollinearity did not appear to be an issue. Thus, I retained all of the control variables in the dataset for the regression analyses.

Table 3

Correlation Matrix for Teacher Control Variables (N = 1080)

Variable	1	2	3	4	5	6
1. Age	--					
2. Gender ^a	.111***	--				
3. Race ^a	-.044		--			
4. Ethnicity ^a	.004			--		
5. NYT	.064*	-.005	.008	-.064*	--	
6. NGT	-.037	.069*	.064*	-.043	-.004	--

Note. NYT = number of years of teaching experience; NGT = number of grades taught. Blank cells below the diagonal not applicable for correlation analyses due to the categorical nature of the variables. Chi-square analyses were conducted for these variables.

^aCorrelation analyzed using Pearson point-biserial (PBis) statistic. All other correlations analyzed using Pearson alpha coefficient.

* $p < .05$ *** $p < .001$

Table 4 presents the correlation matrix between the teacher control variables and the predictor and outcomes variables of interest in the present study. Although a few of the control variables were significantly related to the predictor and outcome variables, the strength of the correlations were weak and do not indicate a meaningful relationship between the variables. This finding suggests that the teacher control variables does not play a significant role in the upcoming regression models.

Table 4

Correlation Matrix for Teacher Control Variables, Predictor, and Outcome Variables (N = 1080)

Variable	Age	Gender ^a	Ethnicity ^a	Race ^a	NYT	NGT
PREDICTOR						
Preparation	-.102***	.007	-.023	.085**	.202***	.043
Induction	.002	.034	-.006	-.068*	-.090**	-.053*
OUTCOME						
Perceptions	-.063*	-.008	-.021	.067*	-.027	.013
Intentions ^a	.147***				-.040	-.048

Note. NYT = Number of years of teaching experience; NGT = number of grades taught; Preparation = preparation pathway comprehensiveness; Induction = induction program comprehensiveness; Perceptions = perceptions of preparedness to teach; Intentions = intentions to remain in the teaching profession. Blank cells not applicable for correlation analyses due to categorical nature of variables. Chi-square analyses were conducted for these variables.

^aCorrelation analyzed using Pearson point-biserial (PBis) statistic. All other correlations analyzed using Pearson alpha coefficient.

*p < .05 **p < .01 ***p < .001

In order to determine if any relationships existed between two categorical variables, a Pearson's Chi-square test of independence was conducted. Using SPSS's crosstab feature, no relationships were discovered among the categorical control variables *gender* and *ethnicity* as well as *ethnicity* and *race*. A significant relationship was found, however, between the

control variables *gender* and *race*, such that the number of male and female non-white novice teachers in the sample was significantly different from the number of white male and female novice teachers, $\chi^2 = 5.22$, $p = .022$, Cramer's $V = .070$. There were significantly less non-white male and female novice teachers than white male and female novice teachers in the sample. This relationship was due to the high percentage of white novice teachers, in comparison to non-white novice teachers, in the study sample. No significant relationships were found between the control variables (e.g., gender, ethnicity, race) and the outcome variable *intentions to remain in the teaching profession*.

Predicting Novice Teachers' Perceptions of Preparedness

In the present study, I examined the extent to which middle and secondary novice STEM teachers' perceptions of preparedness to teach were associated with the comprehensiveness of their preparation pathways and the comprehensiveness of their induction program experiences, and I investigated a possible moderating relationship between these two predictor variables. A hierarchical linear regression analysis was conducted in order to examine the amount of variability in novice STEM teachers' perceptions of preparedness to teach that could be accounted for by their education (e.g., preparation pathway comprehensiveness) and training (e.g., induction program comprehensiveness) experiences.

The results of the hierarchical linear regression analysis are presented in Table 5. Overall, the regression model accounted for 6% of the variance for perceptions of preparedness. Step one, which included the control variables, did not account for a significant change to the variance explained in novice STEM teachers' perceptions of preparedness, $\Delta F(6, 1070) = 1.702$, $p = .117$. The inclusion of the predictor variables in step

two, however, did account for a significant change in the explained variance in novice teachers' perceptions of preparedness, $\Delta F(2, 1070) = 26.618, p = .000$. Nearly 5% of the variance in middle and secondary novice STEM teachers' perceptions of preparedness to teach was explained by the comprehensiveness of their preparation pathways and induction programs collectively, after accounting for the control variables. Further review of the individual regression coefficients revealed that the variable *preparation pathway comprehensiveness* was the significant contributor. Step three, which examined a possible interaction between the two predictor variables, did not add significantly to the variance explained in novice teachers' perceptions of preparedness to teach, $\Delta F(1, 1070) = 1.435, p = .231$. This suggested that the relationship between novice teachers' preparation pathways comprehensiveness and perceptions of preparedness to teach did not differ based on the comprehensiveness of novice teachers' induction programs. Examination of the residuals confirmed that the underlying assumptions of multiple linear regressions were supported.

Table 5

Hierarchical Linear Regression Analysis Evaluating Predictors of Novice Teacher Perceptions of Preparedness to Teach (N = 1080)

Variable	Perceptions of preparedness to teach	
	ΔR^2	β
Step 1	.009	
Control variables ^a		.066
Step 2	.047***	
Preparation		.218***
Induction		.048
Step 3	.001	
Preparation X		.095
Induction		

Note. Preparation = preparation pathway comprehensiveness; Induction = induction program comprehensiveness. Betas reported are those from the step at which the variable was entered.

^aControl variables included age, gender, race, ethnicity, number of years of teaching experience, and number of grades taught.

*** $p < .001$

Predicting Novice Teachers' Intentions to Remain in the Teaching Profession

In the present study, I examined the extent to which middle and secondary novice STEM teachers' intentions to remain in the teaching profession were associated with the comprehensiveness of their preparation pathways and the comprehensiveness of their induction program experiences, and I investigated a possible moderating relationship between these two predictor variables. A binary logistic regression analysis¹ was conducted in order to examine how well inclusion of the predictor variables resulted in an improved fit of the model measuring novices' intentions to remain in the teaching profession.

The results of the binary logistic regression analysis are presented in Table 6. Step one, which included the control variables, significantly improved the fit of the model, $\chi^2(6, 1080) = 32.237, p = .000$, Cox and Snell $R^2 = .030$, Nagelkerke $R^2 = .041$. In particular, age was a significant predictor of novice teachers' intentions to remain in the teaching profession. Inclusion of the predictor variables in the second step indicated that preparation pathway comprehensiveness and induction program comprehensiveness, collectively, predicted teachers' intentions to remain in the teaching profession, $\chi^2(2, 1080) = 27.059, p = .000$, Cox and Snell $R^2 = .054$, Nagelkerke $R^2 = .074$. This step produced an increase in Nagelkerke R^2 of .033 over the regression model containing only the control variables demonstrating that, overall, the model with the predictor variables was a better fit than the model without the predictor variables. Further review of the individual Wald's χ^2 and odds ratios revealed that both preparation pathway comprehensiveness and induction program comprehensiveness were significant predictors of novice STEM teacher's intentions to remain in the teaching

¹ Logistic regression analyses were also conducted with the response option (h) *Undecided at this time* filtered out from the survey question, "How long do you intend to remain in the teaching profession?" Results yielded the same findings. Please contact the author for tables and additional information.

profession. Step three, which examined a possible interaction between the two predictor variables, did not add significantly to the fit of the model predicting novice teachers' intentions to remain in teaching, $\chi^2(1, 1080) = .003, p = .960$, Cox and Snell $R^2 = .054$, Nagelkerke $R^2 = .074$. This indicated that there was no interaction effect between the two main variables of interest in the study on middle and secondary novice STEM teachers' intentions to remain in teaching. Due to the lack of a significant association, I did not conduct further examination of the Wald's χ^2 statistic.

Table 6

Binary Logistic Regression Analysis Evaluating Predictors of Novice Teacher Intentions to Remain in Teaching Long-Term (N = 1080)

Variable	Intentions to remain in teaching					
	β	<i>SE</i>	Wald	<i>df</i>	<i>Sig</i>	<i>OR</i>
Step 1						
Control variables ^a	.043	.009	23.986	1	.000	1.044
Step 2						
Preparation	.204	.061	11.022	1	.001	1.226
Induction	.148	.037	15.721	1	.000	1.160
Step 3						
Preparation X Induction	.002	.033	.003	1	.960	1.002

Note. Wald = Wald's chi-square statistic; *OR* = odds ratio; Preparation = preparation pathway comprehensiveness; Induction = induction program comprehensiveness.

^aControl variables included age, gender, race, ethnicity, number of years of teaching experience, and number of grades taught. Data reported for *age*, which was the only significant control variable in the analysis.

CHAPTER 8

DISCUSSION

Novice teachers commonly experience challenging classroom situations and isolation from colleagues. Thus, it has become critical to examine how education, training, and support services effectively prepare new educators for the trials of the profession so that more novices feel adequately prepared and view their job as a life-long career. This subject is of particular importance for novice teachers in the science, technology, engineering, and mathematics, or STEM fields, where a shortage of quality educators has reflected the immediate need for research findings that illuminate unique benefits for this select group of teachers.

In the current study, I identified factors that contribute to middle and secondary novice STEM teachers' perceptions of preparedness and intentions to remain in teaching. I found that the comprehensiveness of novice teachers' preparation pathways was significantly associated with their perceptions of preparedness to teach. I also established that the comprehensiveness of both novice teachers' preparation pathways and induction programs were associated with their intentions to remain in the profession. The results of the study suggest that middle and secondary STEM teachers feel more prepared and anticipate longer teaching careers when they experience more comprehensive preparation pathways and induction programs. However, interactions between these two predictors did not appear to contribute to novice STEM teachers' perceptions of teaching or commitment to the

profession. Below I discuss my findings more thoroughly as they relate to the aims of the present study.

Novice Teachers' Perceptions of Preparedness

Recently, researchers have found that novice teachers who completed preparation pathways with a comprehensive number of components (e.g., extensive student teaching experiences, full certification, etc.) are likely to feel more prepared to teach than novice teachers whose preparation pathways were not as comprehensive (Imbimbo & Silvernail, 1999; Turley & Nakai, 2000). Feiman-Nemser (2001) also noted that much of the success of such programs could be attributed to their ability to connect theory and practice, through coursework and student teaching experiences. Findings from the present study also suggest that this may be taking place. Novice teachers who participated in more comprehensive preparation pathways reported more favorable perceptions of preparedness to teach than novice teachers whose preparation pathways were not as comprehensive, thus confirming my first hypothesis. These results suggest that including elements of comprehension, such as five or more courses in teaching methods or practice teaching experiences that last 12 weeks or longer, into preparation pathways may result in novice educators with more favorable perceptions of preparedness during their first year the profession. However, while the contributions of these factors were significant, they were small in magnitude. This led me to believe that other factors not addressed in the present study are also likely to contribute to middle and secondary novice STEM teachers' perceptions of preparedness to teach. Findings from the present study revealed that novice teachers who participated in more comprehensive induction programs did not report more favorable perceptions of preparedness to teach than novice teachers whose induction programs were not as

comprehensive, thereby failing to confirm my second hypothesis. Although previous researchers have found that novice teachers who participate in an induction program feel more prepared to teach than those who have not experienced an induction program, the mean difference in feelings of preparedness was small in magnitude (Flanagan & Fowler, 2010). These findings, combined with my research results, suggest that other factors are likely to be more strongly associated with STEM teachers' perceptions of preparedness than the comprehensiveness of their induction program. In particular, it is possible that factors related to individuals' unique occupational values could impact their perceptions of preparedness more so than participation in an induction program. According to Meikle (2008), individuals choose occupations that fit into their professional self-concept, or perception of themselves in relation to their career goals. As novice teachers gain experience in the classroom, setbacks and achievements help them to determine whether the career path they are pursuing continues to fit into their self-concept (Brown, 2002; Meikle, 2008). If a novice teacher's occupational values shift from her original professional self-concept, possibly due to a series of discouraging setbacks, she may report less favorable perceptions of preparedness to teach. On the other hand, if a novice teacher excels within the profession, her occupational values may remain aligned with her career goals and she may report more favorable perceptions of preparedness. However, due to the nature of secondary data analyses, I was limited to using data that was previously collected and, thereby, prevented from further investigating novice teachers' occupational values. Future research could investigate the occupational values of novice STEM educators as they relate to their perceptions of preparedness and participation in comprehensive induction programs.

In the present study, I also considered the extent to which induction comprehensiveness moderated the relationship between preparation and perceptions of preparedness for novice STEM teachers. However, my results did not reveal the findings I was expecting. The positive effects of participating in a comprehensive induction program on perceptions of preparedness were *not* greater for teachers who received a less comprehensive preparation pathway. In light of my previous findings on the relationship between induction program comprehensiveness and novice teachers' perceptions of preparedness, these results are not entirely surprising. Since the comprehensiveness of novice teachers' induction programs was not found to be associated with novice teachers' perceptions of preparedness, it was unlikely that induction program comprehensiveness would moderate the relationship between the comprehensiveness of novice teachers' preparation pathways and their perceptions of preparedness.

A few explanations could justify this finding. First, the role of many teacher preparation programs is to effectively *prepare* quality teachers to become educators in public schools. On the other hand, the role of many induction programs is to provide support and guidance for educators once they enter the classroom in order to *retain* quality teachers for long-term careers in the field. Due to the differing goals of such programs (i.e., prepare vs. retain quality educators), it is unlikely that a novice teacher entering the profession with inadequate perceptions of preparedness, due to a weak preparation, could gain all the needed skills and knowledge to become an effective educator through an induction program alone. Therefore, the findings revealing that induction program comprehensiveness does not moderate the relationship between novice teachers' preparation pathway and perceptions of preparedness are justified.

Additionally, previous research on the outcome variable *perceptions of preparedness* was scarce within the teacher preparation and induction literature. Therefore, most of the hypotheses I made in relation to this variable involved some level of speculation based on research findings in related areas. While I attempted to justify my hypotheses with research findings on the individual relationships between preparation pathway comprehensiveness and induction program comprehensiveness on novice teachers' perceptions of preparedness, sometimes these research findings were difficult to find. Further examination of the research field in these areas, as they continue to develop, may provide greater understanding of the relationships between these variables.

Nevertheless, although the findings from the present study did not confirm my third hypothesis, they are still informative for the greater research community. These findings can inform future researchers that moderation does not exist between preparation pathways and induction programs on novice teachers' perceptions of preparedness. Additionally, these results also demonstrate that perceptions of preparedness may not be a suitable outcome measure in relation to research on novice teachers' induction programs. Rather, it may be best for future researchers to continue to focus on outcomes of retention in relation to induction programs, as this process is a main goal of induction program practices.

Through this research finding, I have also realized that moderation may not have been the most suitable hypothesis for the relationship between these variables. Instead, it may have been more informative to examine how well the services offered in novice STEM teachers' induction programs fit their needs based on their preparation backgrounds. It is possible that novice STEM teachers who did not receive comprehensive preparation in pedagogical knowledge or classroom management may benefit from an induction program that focuses on

providing these supports. Likewise, those novice STEM teachers who are accustomed to collaborating with peers and receiving feedback from instructors may benefit from induction programs that continue these services. If future researchers are to continue examining novice teachers' perceptions of preparedness in relation to teachers' participation in preparation pathways and induction programs, these alternative ways of depicting the relationship between these variables could be further researched and discussed in order to gain a better understanding of whether a relationship does, in fact, exist between these factors.

Novice Teachers' Intentions to Remain in Teaching

Few research studies have previously examined the relationship between preparation pathways and novice teachers' career intentions, particularly on a large, national level. Furthermore, examination of the relationships between preparation pathways and induction programs on retention intentions for the particularly vulnerable STEM population is almost non-existent (Ingersoll, 2011). Nevertheless, many researchers have suggested the need for such research (Freedman & Appleman, 2009; Johnson, Berg, & Donaldson, 2005; Rosenberg, Boyer, Sindelar, & Misra, 2007). The results from the present study have attempted to fill these gaps in research.

Findings from the present study revealed that novice teachers who participated in more comprehensive preparation pathways reported long-term intentions to remain in the teaching profession, thus confirming my fourth hypothesis. Recently, Ingersoll and colleagues (2011) have also found that novice teachers who completed preparation pathways with a comprehensive number of components (e.g., extensive student teaching experiences, full certification, courses in teaching methods and strategies, etc.) are less likely to leave the profession than their weaker prepared counterparts. These complementary findings revealed

an association between preparation pathway comprehensiveness and novice STEM teachers' long-term career intentions that previously had not been established. These results expand upon our knowledge of teacher preparation programs and their subsequent effect on teachers' retention intentions. Future research can use information gleaned from this study, and from the research by Ingersoll and colleagues (2011), to further explore the relationship between these variables.

Findings from the present study also revealed that novice STEM teachers who participated in a comprehensive induction program were more likely to report long-term intentions to remain in the profession than teachers whose induction programs were not as comprehensive, thereby confirming my fifth hypothesis. While the relationship between induction program participation and teacher retention has been previously established (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004), these findings added to the research literature by establishing a relationship between the *comprehensiveness* of the induction program on novice teachers' retention intentions. This result demonstrates that the structure and quality of induction programs matters in achieving the primary goal of retaining teachers in the field. For those programs that are struggling with teacher retention issues, a deeper look at the comprehensiveness of their induction program may provide some informative explanations for such issues. Nevertheless, it is important to note that as a large-scale national survey, the SASS Public School Teacher Questionnaire was not able to capture all elements of the depth, breadth, and duration of induction programs, thus limiting the extent to which I could emphasize *how* participation in such programs affected novice teachers' intentions to remain in the teaching profession long-term. Future research could attempt to

assess these components of induction program comprehensiveness to understand more fully how they relate to novice teachers' intentions to remain in teaching and overall retention.

In the present study, I also considered the extent to which induction comprehensiveness moderated the relationship between preparation and retention intentions for novice STEM teachers. Previous researchers have suggested that the quality of teachers' induction programs may contribute to novice educators' commitment intentions more than the quality of their preparation pathway (Duke, Karson, & Wheeler, 2006). Using the 1999-2000 version of the Schools and Staffing Survey, these researchers found that novice teachers from weak preparation pathways who participated in an induction program during their first year of teaching demonstrated a greater commitment to the profession than novice teachers who participated in a strong preparation pathway, but did not receive induction support. They concluded that participation in an induction program compensated for obtaining a weak preparation pathway in relation to novice teachers' commitment to the profession. While my sixth hypothesis predicted similar findings in relation to novice teachers' intentions to remain in the profession, my results do not suggest this is occurring. Rather, the positive effects of participating in a comprehensive induction program on intentions to remain in teaching were *not* greater for teachers who received a less comprehensive preparation pathway. Although I failed to confirm my hypothesis, this result is significant because it fails to provide support for findings from previous researchers who used the same survey, albeit an earlier version, to analyze their data. One possible explanation for these conflicting reports involves differences in the sample population of the two studies. The present study examined 1,080 individuals, specifically full-time, novice, middle and secondary STEM teachers. On the other hand, the previous research study examined nearly 42,550 teachers, including all public school

teachers who participated in the 1999-2000 version of the Schools and Staffing Survey. It is possible that the differences in sample sizes and inclusion or exclusion of participants may have resulted in these conflicting reports. Future research studies can examine both of these findings more carefully in order to resolve these conflicting reports.

Limitations

In this study, I explored the extent to which participation in comprehensive preparation pathways and induction programs were associated with novice STEM teachers' perceptions of preparedness and retention intentions. Findings revealed that there are, in fact, relationships between these variables. These findings are significant because prior researchers have not looked at the comprehensiveness of these factors as they relate to the outcomes examined. Furthermore, little research has previously been conducted on the relationship between education and support services on perceptions and retention intentions of teachers in the STEM fields. These results expand the knowledge in the field and add to the research literature on novice teacher perceptions of preparedness and intentions to remain in teaching.

While it is important to highlight the strengths of the present study, it is also necessary to acknowledge the limitations. The first limitation involves the extent to which other factors, such as school or classroom conditions, may have played a significant role in novice STEM teachers' perceptions of preparedness and intentions to remain in teaching. The second limitation addresses possible biases in participants' survey responses, such as selection bias, social desirability bias, and retrospective bias. Finally, the third limitation identifies aspects of the study design that may have restricted my analyses.

Results of the present study revealed that there are relationships between the

comprehensiveness of teachers' preparation pathways and induction programs and their perceptions of preparedness and intentions to remain in teaching. Nevertheless, the minimal magnitude of these findings suggests that additional factors should also be considered in predicting these outcome variables. One such factor that was not included in the present study was the effect of school conditions on novice teachers' retention intentions. Research by Smith and Ingersoll (2004) suggests that induction programs' effects on novice teacher retention can vary by school setting. Following their initial analysis that determined the strong, positive effects of induction programs on teacher retention, the researchers conducted a follow-up study that disaggregated the data from the 1999-2000 SASS into high and low poverty levels. Their findings revealed that the impact of induction on teacher retention varied significantly by poverty level. Specifically, those teachers from low-poverty schools reported much higher retention rates than teachers from high-poverty schools (Ingersoll & Smith, 2004). The researchers concluded that induction programs may not contribute equally to novice teacher retention, but rather may depend on the schools' context. These results align with statistics demonstrating that a higher percentage of urban school districts are in immediate need of STEM teachers than school districts in suburban areas (Lawrenz et al., 2006). While analysis of school conditions was beyond the scope of the current study, future analyses that include measures of these factors may further expand upon our understanding of how comprehensive support and guidance programs are associated with novice STEM teachers' commitment to the profession.

In the current study, I also failed to take into account the classroom conditions to which novice teachers were exposed. With the rising number of English-language learners and special needs students in today's classrooms, as well as a culture of teaching that is

heavily influenced by testing and accountability measures, otherwise confident and committed teachers may struggle to feel prepared or may not plan to remain in the profession long-term (Beers, 2011; Hayes, 2009; President's Council of Advisors on Science and Technology, 2010). The questions available did not allow for analysis of *why* a novice teacher reported more or less favorable feelings of preparedness or differing intentions to remain in the profession. Future research could incorporate qualitative components that further our understanding of what conditions within classroom environments are associated with novice teachers' perceptions of preparedness and intentions to remain in teaching.

In researching STEM educators, it is also important to examine what other factors, unique to this population, may play a role in their perceptions of preparedness and intentions to remain in the profession. As Ingersoll (2011) noted, the majority of novice STEM teachers entering the field do not hold an education degree, but rather a degree in their main field (e.g., science, mathematics, etc.). While this may produce novice teachers with significant subject-matter knowledge, their pedagogical skills may be weaker. Although I attempted to account for subject-matter knowledge and pedagogical skills in novice teachers' education and training backgrounds, possession of a non-education degree may have affected their perceptions of preparedness and intentions to remain in teaching in ways that were not taken into account in the present study. Future researchers could include this element of preparation in their consideration of novice educator's education and training background in order to gain a more complete understanding of the relationship between STEM teacher preparation and these outcomes.

Likewise, teachers in the STEM fields may also be more likely to leave the teaching profession long before retirement age due to other career opportunities in their field. In the

current occupational landscape, the skills related to STEM are highly marketable. The difference in salary opportunities between being a STEM teacher in a public school and an individual working in the business sector is vast (LaTurner, 2002). Furthermore, considerations such as working schedule, benefits, and working conditions, among other factors, are likely to play a simultaneous role in an individual's decision to leave or remain in the teaching profession (Freedman & Appleman, 2009; Ingersoll & May, 2010; Ingersoll & Strong, 2011; Johnson, Berg, & Donaldson, 2005). Inclusion of all of these simultaneous factors was beyond the scope of the present study, however, future research could include these factors in order to understand more fully the unique circumstances upon which novice STEM educators intend to remain or leave the profession.

A second limitation of the present study involved possible biases inherent in participant responses to the SASS Teacher Questionnaire. First, I was only able to review responses from those individuals who *voluntarily* filled out the questionnaire in its entirety, revealing a possible selection bias. While the U.S. Census Bureau used numerous techniques, including letters, telephone calls, and field visits, to encourage a high response rate, nearly 25% of individuals did not respond or did not complete the full questionnaire (U.S. Department of Education, 2008). This raised concerns about differences regarding the occupational values, attitudes, and experiences of respondents and non-respondents. It is possible that those individuals who did not respond to the survey were the same individuals who felt less prepared to teach or were less committed to the profession than those participants who did respond to the questionnaire. Furthermore, if non-respondents differed from respondents in filling out the survey, it is possible there are other differences between the two groups that may have affected the results of the study. For example, those individuals

who responded to the questionnaire may have been more likely to seek out comprehensive preparation pathways or induction programs, while non-respondents may not have taken such initiative.

Selection bias threatens the internal validity of the study and limits my ability to generalize the findings. Due to selection bias, inherent differences between respondents and non-respondents may make the relationship between the predictor (e.g., preparation pathway comprehensiveness; induction program comprehensiveness) and dependent variable (e.g., perceptions of preparedness; intentions to remain in teaching) look more pronounced than it actually is. This threatens my ability to determine the extent to which the design of the study predicts the suggested relationships as opposed to alternative explanations. Furthermore, since it is possible that respondents have innate characteristics that are different from non-respondents, I am limited in my ability to generalize my results to the broader population of all novice STEM teachers. Rather, I am restricted to only suggesting that these findings are relevant for novice STEM teachers who are likely to respond to a questionnaire regarding their attitudes and behaviors about teaching. Future researchers should be aware of these limitations of the present study and take measures to reduce or eliminate selection bias. Although there is no easy solution for this problem of selection bias, it is important to highlight in order to inform the reader of the possibility of skewed results.

Issues of social desirability were also of concern in the present study. It is possible that individuals may have exaggerated their questionnaire responses in order to present themselves favorably. When confronted with the task of ranking how prepared one felt to teach during their first year in the profession, respondents may have felt pressured to answer more positively about their feelings of preparedness than they actually felt in order to avoid

appearing as if they were under-prepared for the profession. Likewise, for the question regarding how long an individual intended to remain in teaching, participants may have been hesitant to disclose their true intentions for fear of appearing uncommitted to their work and profession. In each of these situations it is possible that social desirability bias played a role in participants' responses. This may have threatened the internal validity of the study by increasing the likelihood of skewed results (e.g., novice STEM teachers reporting more favorable perceptions of preparedness than they actually felt) and minimizing my ability to attribute favorable perceptions of preparedness solely on the comprehensiveness novice STEM teachers' preparation pathways.

Retrospective bias may have also contributed to the results of the present study. Individuals responding to the perceptions of preparedness question were asked to think back to their first year of teaching in order to rank how well prepared they felt to teach. Although the current study focused on teachers of novice status, some individuals were teaching in their first year while others were teaching in their second or third years. For those teachers in their first year, 34% of the study sample, ranking their perceptions of preparedness may not have been difficult as they were simultaneously encountering those feelings. Nevertheless, with additional years of teaching experience, second and third year novice teachers may not have had a clear memory of what their feelings of preparedness were during their first year. Instead, retrospective bias may have contributed to an over- or under-inflation of rankings.

While biases and additional factors may have contributed to some of the limitations of the present study, aspects of the study design limited my analyses. For example, I was unable to investigate actual retention rates of novice teachers due to the cross-sectional design of the present study. While intentions to remain in the teaching profession served as a

proxy for novice teachers' commitment to the profession, actual retention rates would have provided more accurate examples of the behaviors of novice teachers. Future studies could include a longitudinal component that compared novice teachers' retention intentions with their actual retention rates in order to define the relationship between these two variables more fully.

Future research related to these variables can also examine the relationship between novice teachers' perceptions of preparedness on their retention in the profession and track the extent to which perceptions of preparedness change over the course of an individual's novice years. Findings from such studies may illuminate the extent to which novices' perceptions of preparedness are a factor in their career decisions. Additionally, further examination of teacher perceptions may help to indicate specific areas of weakness or confidence issues novice teachers may have. Addressing these issues early, or in teacher preparation programs, may help to improve novice teacher perceptions and, likewise, intentions to remain in the profession.

Conclusions

The results of the present study provide important evidence in furthering our understanding of the factors associated with the perceptions and retention intentions of STEM educators. With nearly 75% of STEM educators entering the profession from non-education backgrounds in science and math (Ingersoll, 2011), it has become increasingly important to understand which factors in an individual's preparation pathway are associated with more favorable perceptions and long-term intentions to remain in teaching. My findings indicate that novice STEM teachers who participated in comprehensive preparation pathways, that included components such as courses in teaching methods and strategies,

extensive practice teaching experience, and full state certification, reported more favorable perceptions and long-term retention intentions. This suggests that teacher candidates in STEM-related areas may benefit from participating in preparation pathways, traditional or alternative, that include these comprehensive elements.

Novice STEM teachers may also benefit from participating in comprehensive induction programs. Findings from the present study revealed that novice STEM teachers who participated in more comprehensive induction programs reported long-term intentions to remain in the profession. This research finding aligns with prior research indicating that induction programs and access to a mentor reduces novice teachers' early exit from the classroom (Ingersoll & Strong, 2011; Smith & Ingersoll, 2004), and it expands our understanding of commitment intentions specifically for teachers in the STEM field. This finding is of crucial importance given reports of numerous STEM teachers leaving the field long before retirement age. Schools administering induction programs may use the knowledge from the present study to review the comprehensiveness of such programs and examine whether novice STEM teachers are receiving extensive support and guidance services.

In order to effectively prepare students for the expectations of our modern society, it is imperative to understand the way in which STEM teachers themselves are educated and supported so that well-prepared STEM teachers enter and remain in the profession long-term. The results of the present study provide recommendations for educators and researchers alike. My findings help to inform teacher educators and school administrators of the elements in teachers' educational preparation and induction program support services that are associated with more favorable perceptions of preparedness and long-term intentions to

remain in the profession. Furthermore, the results of the present study add to the research literature within the field and expand our understanding of how the comprehensiveness of education and support programs relates to novice STEM teacher perceptions of preparedness and intentions to remain in teaching. My findings provide evidence that there are relationships between these variables, although it is important to realize that additional factors should also be considered. Nevertheless, the knowledge from this study can be applied to future research, thereby enhancing our understanding of how novice STEM teachers entering the profession today view the teaching career.

Appendix A: List of SASS Questionnaires for the 2007-2008 Administration

2007-2008 SASS Questionnaires (U.S. Department of Education, 2008):

- Teacher Listing Form Questionnaire
- School District Questionnaire (also known as the Teacher Demand and Shortage Questionnaire until the 1999-2000 SASS administration)
- Public School Questionnaire
- Private School Questionnaire
- Unified School Questionnaire
- Public School Principal Questionnaire
- Private School Principal Questionnaire
- Public School Teacher Questionnaire
- Private School Teacher Questionnaire
- Public School Library Media Center Questionnaire

Appendix B: Survey Questions, Original Response Options, and Recoded Response Options for Proposed *Preparation Pathway Comprehensiveness* Variable

Topic	Survey Question	Original Response Options	LFG Recoded Response Options
<i>Teaching Methods/Strategies</i>	Have you ever taken any graduate or undergraduate courses that focused on teaching methods or teaching strategies?	1 = Yes 2 = No	N/A; # of courses below
	How many courses?	1 = 1 or 2 courses 2 = 3 or 4 courses 3 = 5 to 9 courses 4 = 10 or more courses	0 = Less than five courses 1 = Five or more courses
<i>Practice Teaching</i>	How long did your practice teaching last?	1 = I had no practice teaching 2 = 4 weeks or less 3 = 5-7 weeks 4 = 8-11 weeks 5 = 12 weeks or more	0 = Less than 12 weeks 1 = 12 weeks or more
<i>BA Degree</i>	Do you have a bachelor's degree?	1 = Yes 2 = No	N/A
<i>Full State Certification</i>	Which of the following describes the teaching certificate you currently hold in THIS state?	1 = Regular or standard state certification or advanced professional certificate [REGULAR] 2 = Certificate issued after satisfying all requirements except the completion of a probationary period [PROBATIONARY] 3 = Certificate that requires some additional coursework, student teaching, or passage of a test before regular certification can be obtained [TEMPORARY] 4 = Certificate issued to persons who must complete a certification program in order to continue teaching [WAIVER] 5 = I do not hold any of the above certifications in THIS state [NONE]	0 = None; Waiver; Temporary; Probationary 1 = Regular
<i>Subject Area Competency</i>	<u>Certification</u> : In what content area(s) does your teaching certificate allow you to teach? <u>Subject Area</u> : This school year, what is your MAIN teaching assignment field at THIS school?	N/A	0 = No match between certification & teaching assignment codes 1 = Match between certification & teaching assignment codes

Appendix C: STEM-related Certification Content Area Codes and Matching Field Area

Subject Matter	Code	Field
Mathematics and Computer	190	Mathematics
	197	Computer Science
Natural Sciences	210	Science, general
	211	Biology or life sciences
	212	Chemistry
	213	Earth Sciences
	216	Physical Sciences
	217	Physics
	218	Other natural sciences

Appendix D: STEM-related Teaching Assignment Codes and Matching Field Area

Subject Matter	Code	Field
Mathematics and Computer Science	191	Algebra I
	192	Algebra II
	193	Algebra III
	194	Basic and general
	195	Business and applied math
	196	Calculus and pre-calculus
	197	Computer science
	198	Geometry
	199	Pre-algebra
	200	Statistics and probability
	201	Trigonometry
Natural Sciences	210	Science, general
	211	Biology or life sciences
	212	Chemistry
	213	Earth Sciences
	215	Integrated science
	216	Physical Sciences
	217	Physics

References

- Aiken, L. & West, S. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage Publications Inc.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179-211.
- Andrews, S., & Martin, E. (2003). No teacher left behind: Mentoring and supporting novice teachers. Paper presented at: *The Annual Meeting of the Georgia Association of Colleges for Teacher Education*. St. Simons Island, GA.
- Andrews, B., & Quinn, R. (2005). The effects of mentoring on first-year teachers' perceptions of support received. *The Clearing House*, 78(3), 110-116.
- Bandura, A. (1995). Exercise of personal and collective efficacy in changing societies. In A. Bandura (Ed.), *Self-efficacy in changing societies* (pp. 1-46). Cambridge, UK: Cambridge University Press.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.
- Beers, S. (2011). *21st century skills: Preparing students for their future*. Retrieved from McGraw Hill website:
https://www.mheonline.com/glencoemath/pdf/21st_century_skills.pdf
- Berliner, D. (1986). In pursuit of the expert pedagogue. *Educational Researcher*, 15, 5-13.
- Boyd, D., Grossman, P., Lankford, H., Loeb, S., & Wyckoff, J. (2009). Teacher preparation and student achievement. *Educational Evaluation and Policy Analysis*, 31(4), 416-440.
- Brown, D. (2002). The role of work and cultural values in occupational choice, satisfaction, and success: A theoretical statement. *Journal of Counseling and Development*, 80, 48-56.
- Corbell, K. (2008). *Evaluating the perceptions of success inventory for beginning teachers and its connection to teacher retention*. (Unpublished doctoral dissertation). North Carolina State University, Raleigh, NC.
- Corbell, K., Booth, S., & Reiman, A. (2010). The commitment and retention intentions of traditionally and alternatively licensed math and science beginning teachers. *Journal of Curriculum and Instruction*, 4(1), 50-69.
- Darling-Hammond, L. (1999). *Teacher quality and student achievement: A review of state policy evidence*. Seattle, WA: University of Washington, Center for the Study of Teaching and Policy.

- Darling-Hammond, L., Chung, R., Frelow, F., & Fisher, H. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach? *Journal of Teacher Education*, 53(4), 286-302.
- Darling-Hammond, L., & Cobb, V. (1996). The changing context of teacher education. In F. Murraray (Ed.), *The teacher educator's handbook: Building a knowledge base for the preparation of teachers* (pp. 14-62). San Francisco: Jossey-Bass.
- Darling-Hammond, L., Eiler, M., & Marcus, A. (2002). Perceptions of preparedness: Using survey data to assess teacher education outcomes. *Issues in Teacher Education*, 11(1), 65-84.
- Dickman, A., Schwabe, A., Schmidt, J., & Henken, R. (2009). *Preparing the future workforce: Science, technology, engineering and math (STEM) policy in K-12 education*. Retrieved from the Public Policy Forum website: <http://www.publicpolicyforum.org/pdfs/2009STEM.pdf>
- Donaldson, M., & Johnson, S. (2010). The price of misassignment: The role of teaching assignments in Teach for America teachers' exit from low-income schools and the teaching profession. *Educational Evaluation and Policy Analysis*, 32(2), 292-323.
- Duke, L., Karson, A., & Wheeler, J. (2006). Do mentoring and induction programs have greater benefits for teachers who lack preservice training? *Journal of Public and International Affairs*, 4, 61-82.
- Evertson, C., Hawley, W., & Zlotnick, M. (1985). Making a difference in educational quality through teacher education. *Journal of Teacher Education*, 36(3), 2-12.
- Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record*, 103(6), 1013-1055.
- Flanagan, J., & Fowler Jr., W. (2010). Induction programs' effect on beginning teachers' feelings of preparedness and plans to remain in teaching. Paper presented to the Society for Research on Educational Effectiveness, Washington, DC.
- Fulton, K., & Britton, T. (2011). *STEM teachers in professional learning communities: From good teachers to great teaching*. Washington DC: National Commission on Teaching and America's Future.
- Freedman, S., & Appleman, D. (2009). In it for the long haul: How teacher education can contribute to retention in high-poverty, urban schools. *Journal of Teacher Education* 60(3), 323-337.
- Hayes, C. (2009). Proceedings from Edge Conference 2009: *The influence of self-efficacy beliefs on perceptions of preparedness for new teachers*. St. John's,

Newfoundland & Labrador, CANADA.

- Hoy, A., & Spero, R. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education, 21*, 343-356.
- IBM. (2010, June 10). Re: Point-biserial correlations in SPSS [Online forum comment]. Retrieved from <http://www-01.ibm.com/support/docview.wss?uid=swg21476004>
- Imbimbo, J., & Silvernail, D. (1999). *Prepared to teach? Key findings of the New York City Teacher Survey*. New York: New Visions for Public Schools.
- Ingersoll, R. (1999). The problem of underqualified teachers in American secondary schools. *Educational Researcher, 28*(2), 26-37.
- Ingersoll, R. (2002). *Out-of-field teaching: Educational inequality and the organization of schools: An exploratory analysis*. Seattle, WA: University of Washington, Center for the Study of Teaching and Policy.
- Ingersoll, R. (2011). Do we produce enough mathematics and science teachers? *Kappan, 92*(6), 37-41.
- Ingersoll, R., & May, H. (2010). *The magnitude, destinations, and determinants of mathematics and science teacher turnover*. Philadelphia, PA: University of Pennsylvania, Consortium for Policy Research in Education.
- Ingersoll, R., Merrill, L., & May, H. (2011, April). *What are the effects of teacher education and preparation on beginning math and science teacher attrition?* Paper presented at the 2011 Annual Meeting of the American Educational Research Association, New Orleans, LA. Retrieved from The Association of Teacher Educators: <http://www.atel.org/pubs/uploads/ingersollexsum.pdf>
- Ingersoll, R., & Perda, D. (2010). Is the supply of mathematics and science teachers sufficient? *American Educational Research Journal, 47*(3), 563-594.
- Ingersoll, R., & Smith, T. (2004). *The impact of induction and mentoring on beginning teacher turnover in high and low poverty schools*. Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.
- Ingersoll, R., & Strong, M. (2011). The impact of induction and mentoring programs for beginning teachers: A critical review of the research. *Review of Educational Research, 81*(2), 201-233.
- Iyer, N., & Soled, S. (2007). Dispositions and perceived preparedness of teacher

- candidates in traditional undergraduate teacher education, master's with licensure, and alternative licensure programs. *Journal of the National Association for Alternative Certification*, 2(1), 66-79.
- Johnson, S., Berg, J., & Donaldson, M. (2005). *Who stays in teaching and why: A review of the literature on teacher retention* (A Project on the Next Generation of Teachers). Cambridge, MA: Harvard Graduate School of Education.
- Johnson, S., & The Project on the Next Generation of Teachers (2004). *Finders and keepers: Helping new teachers survive and thrive in our schools*. San Francisco: Jossey-Bass.
- Jorissen, K. (2003). Successful career transitions: Lessons from urban alternate route teachers who stayed. *High School Journal*, 86(3), 41-52.
- Kinne, M. (2011). *How teachers' perceptions of professional preparedness relate to teacher retention: Comparing traditionally and alternatively prepared teachers*. (Unpublished master's thesis). Georgetown University, Washington DC.
- Klassen, R., & Chiu, M. (2011). The occupational commitment and intention to quit of practicing and pre-service teachers: Influence of self-efficacy, job stress, and teaching context. *Contemporary educational psychology*, 36, 114-129.
- LaTurner, R. (2002). Teachers' academic preparation and commitment to teach math and science. *Teaching and Teacher Education*, 18, 653-663.
- Lawrenz, F., Appleton, J., Bequette, M., Ooms, A., & Wassenberg, D. (2006). Proceedings from STEM ACT Conference: *Tripartite synthesis of research and data on recruitment and retention of STEM teachers*. Arlington, VA.
- Luft, J., Firestone, J., Wong, S., Ortega, I., Adams, K., & Bang, E. (2011). Beginning secondary science teacher induction: A two-year mixed methods study. *Journal of research in science teaching*, 48, 1199-1224.
- McIntyre, D., Byrd, D., & Foxx, S. (1996). Field and laboratory experiences. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp. 171-193). New York: Macmillan.
- Meikle, H. (2008). *The role of occupational values and support in career choice: An emphasis on women in science*. (Unpublished doctoral dissertation). University of South Florida, Tampa, FL.
- Menard, S. (2010). *Logistic regression: From introductory to advanced concepts and applications*. Thousand Oaks, CA: Sage Publications Inc.
- Moore-Hayes, C. (2008). *Teacher-efficacy exploring preservice and beginning teachers'*

- perceptions of preparedness to teach.* (Unpublished doctoral dissertation). Capella University, Minneapolis, MN.
- National Council for Accreditation of Teacher Education (2008). *Professional standards for the accreditation of teacher preparation institutions.* Washington DC: National Council for Accreditation of Teacher Education, p. 1 – 92.
- National Council on Teacher Quality (2011). *Student teaching in the United States.* Washington DC: Julie Greenberg, Laura Pomerance, & Kate Walsh.
- National Research Council, Committee on Science Learning: Computer Games, Simulations, and Education (2011). *Learning Science Through Computer Games and Simulations.* Retrieved from http://www.nap.edu/openbook.php?record_id=13078&page=1
- Newsom (2011). *Logistic regression* [PDF document]. Retrieved from http://www.upa.pdx.edu/IOA/newsom/da2/ho_logistic.pdf
- No Child Left Behind Act, 20 U.S.C. § 6319 (2001).
- President’s Council of Advisors on Science and Technology. (2010). *Prepare and inspire: K-12 education in science, technology, engineering, and math (STEM) for American’s future.* Washington, DC.
- Putnam, R., & Borko, H. (2000). What do new views of knowledge and thinking have to say about research on teacher learning? *Educational Researcher*, 29(1), 4-15.
- Rockoff, J. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *American Economic Review*, 94(2), 247-252.
- Rosenberg, M., Boyer, K., Sindelar, P., & Misra, S. (2007). Alternative route programs for certification in special education: Program infrastructure, instructional delivery, and participant characteristics. *Exceptional Children*, 73(2), 224-241.
- Rosenholtz, S. (1989). Workplace conditions that affect teacher quality and commitment: Implications for teacher induction programs. *The Elementary School Journal*, 89(4), 420-439.
- Sandoval-Lucero, E., Shanklin, N., Sobel, D., Townsend, S., Davis, A, & Kalisher, S. (2011). Voices of beginning teachers: Do paths to preparation make a difference? *Education*, 132(2), 336-350.
- Sigler, E., & Saam, J. (2006). Teacher candidates’ conceptual understanding of conceptual learning: From theory to practice. *Journal of Scholarship of Teaching and Learning*, 6, 118-126.
- Smith, T., & Ingersoll, R. (2004). What are the effects of induction and mentoring on

- beginning teacher turnover? *American Educational Research Journal*, 41(3), 681-714.
- Tamir, E. (2010). The retention question in context-specific teacher education: Do beginning teachers and their program leaders see teachers' future career eye to eye? *Teaching and Teacher Education*, 26, 665-678.
- Teacher Education Accreditation Council (2012). Quality Principles for Teacher Education Programs. Retrieved from <http://www.teac.org/accreditation/goals-principles/>
- Thompson, M., Paek, P., Goe, L., & Ponte, E. (2004). *Study of the impact of the California Formative Assessment and Support System for Teachers (CFASST): Report 2: Relationship of BTSA/CFASST engagement and teacher practices* (ETS-RR-04-31). Washington, DC: Educational Testing Service.
- Tschannen-Moran, M., Hoy, A., & Hoy, W. (1998). Teacher efficacy: Its meaning and measure. *Review of Educational Research*, 68(2), 202-248.
- Turley, S., & Nakai, K. (2000). Two routes to certification: What do student teachers think? *Journal of Teacher Education*, 51(2), 122-134.
- Unruh, L., & Holt, J. (2010). First-year teaching experiences: Are they different for traditionally versus alternatively certified teachers? *Action in Teacher Education*, 32(3), 3-14.
- U.S. Department of Education, Institute of Education Sciences (1999). *Teacher quality: A report on the preparation and qualifications of public school teachers* (NCES Publication No. 1999-080). Retrieved from <http://nces.ed.gov/surveys/frss/publications/1999080/index.asp?sectionid=6>
- U.S. Department of Education, Institute of Education Sciences (2008). *Schools and staffing survey*. Retrieved from <http://nces.ed.gov/surveys/sass>
- U.S. Department of Education, Institute of Education Sciences (2010). Documentation for the 2007-08 Schools and Staffing Survey (Report No. NCES 2010-332).
- Warford, M. (2011). The zone of proximal *teacher* development. *Teacher and Teacher Education*, 27, 252-258.
- Yost, D. (2006). Reflection and self-efficacy: enhancing the retention of qualified teachers from a teacher education perspective. *Teacher Education Quarterly*, 33(4), 59.