8-1-2016

Becoming A Stem Teacher: A Study of Interest in Education Careers Among First-Year Stem Majors

Seher Ahmad
University of Pennsylvania, sehera@gse.upenn.edu

Dr. Ahmad received a joint PhD in Education and Sociology.

Becoming A Stem Teacher: A Study of Interest in Education Careers Among First-Year Stem Majors

Abstract

Despite considerable public attention to STEM teacher shortage, little research has been done on the STEM teacher pipeline. This dissertation compares STEM majors with an interest in secondary school teaching (hereafter referred to as STEM teachers), STEM majors without an intention to enter secondary school teaching (hereafter referred to as STEM majors), and students with an interest in secondary school teaching (hereafter referred to as secondary school teachers). In this dissertation, I investigate individual, family, and institutional variables associated with students' plans to enter STEM majors and pursue a career in education. I utilize Social Cognitive Career Theory (SCCT) framework to understand the major selection process of traditional age, first-year students beginning their undergraduate studies at four-year colleges and universities in the United States. I employ descriptive statistics and a series of logistic regression models using data from the Higher Education Research Institute (HERI) Cooperative Institutional Research Program's (CIRP) American Freshman Surveys. Several important findings emerged but in summary, this dissertation sheds light on the variables associated with interest in STEM teaching and provides both recent and historical empirical evidence related to interest in STEM teaching, and provides directions for future policy and research.

Degree Type

Dissertation

Degree Name

Doctor of Philosophy (PhD)

Graduate Group

Education

First Advisor

Laura W. Perna

Second Advisor

Jerry A. Jacobs

Keywords

STEM teachers, Teacher policy

Subject Categories

Education Policy | Higher Education Administration | Higher Education and Teaching | Sociology

Comments

Dr. Ahmad received a joint PhD in Education and Sociology.

BECOMING A STEM TEACHER: A STUDY OF INTEREST IN EDUCATION CAREERS

AMONG FIRST-YEAR STEM MAJORS

Seher Ahmad

A DISSERTATION

in

Education and Sociology

Presented to the Faculties of the University of Pennsylvania

in

Partial Fulfillment of the Requirements for the

Degree of Doctor of Philosophy

2016

Supervisor of Dissertation

____

Laura W. Perna
James S. Riepe Professor of Higher Education

Co-Supervisor of Dissertation

____

Jerry A. Jacobs
Professor of Sociology

Graduate Group Chairperson, Education:

____

Matthew Hartley, Professor of Higher Education

Graduate Group Chairperson, Sociology:

____

David Grazian, Associate Professor of Sociology

Dissertation Committee:

Laura W. Perna, James S. Riepe Professor of Higher Education

Jerry A. Jacobs, Professor of Sociology

Richard M. Ingersoll, Professor of Education and Sociology

BECOMING A STEM TEACHER: A STUDY OF INTEREST IN EDUCATION

CAREERS AMONG FIRST-YEAR STEM MAJORS

DEDICATION

I dedicate my dissertation to those who believe in the best in people, especially *dada abba* (my grandfather).

ACKNOWLEDGEMENTS

I am grateful to my parents for loving me unconditionally, encouraging me, and giving me the strength to pursue my dreams. I am deeply indebted to both my aunts, Choti Appi and Badi Appi for raising me. To Shayani, Maryam, and Ali for always being my undying supporters and believing I could accomplish anything despite my severe doubts. To Aliya for always rooting for me but also reminding me about weaknesses in my plans and keeping it real. I am grateful to my dear friend Venkat for always listening to me and supporting me as I thought through some difficult things. To Priya for being there for me, guiding me, and for reminding me that it will all work out well in the end. To Sarah for being my friend and mentor, pointing out that there was life outside academics, and teaching me the value of perspective. To Marilia, for listening to me and for anchoring me, so that I stayed the course and finished strong. Their unwavering support even in the face of major obstacles I faced has given me the courage to continue to move forward and complete this dissertation.

A heartfelt thanks to my mentors, Subir and Antwione for setting me on this path. To Emily for encouraging me to apply for the joint PhD program in Sociology and Higher Education. To Laura and Jerry for their patience, wisdom, and guidance, without who this dissertation would not be possible. To Jerry for being an amazing mentor, enabling me to think like a researcher, and always helping me think ahead about options, looking at the big picture, and asking insightful questions. To Laura for teaching me how to write my first solo authored paper, for her super detailed and awesome feedback, and for her unwavering support and encouragement, always. I went to their offices with doubts and questions, and left feeling much much better, until the next time. I am grateful to Richard for asking important questions and for pushing me to go further than I thought possible.

Finally, I would like to thank Karen and Audra for answering all my questions and helping me cross the finish line seamlessly.

ABSTRACT

BECOMING A STEM TEACHER: A STUDY OF INTEREST IN EDUCATION CAREERS AMONG FIRST-YEAR STEM MAJORS

Seher Ahmad

Laura W. Perna

Jerry A. Jacobs

Despite considerable public attention to STEM teacher shortage, little research has been done on the STEM teacher pipeline. This dissertation compares STEM majors with an interest in secondary school teaching (hereafter referred to as STEM teachers), STEM majors without an intention to enter secondary school teaching (hereafter referred to as STEM majors), and students with an interest in secondary school teaching (hereafter referred to as secondary school teachers). In this dissertation, I investigate individual, family, and institutional variables associated with students' plans to enter STEM majors and pursue a career in education. I utilize Social Cognitive Career Theory (SCCT) framework to understand the major selection process of traditional age, first-year students beginning their undergraduate studies at four-year colleges and universities in the United States. I employ descriptive statistics and a series of logistic regression models using data from the Higher Education Research Institute (HERI) Cooperative Institutional Research Program's (CIRP) American Freshman Survey 1976 and 2011 data waves. Several important findings emerged but in summary, this dissertation sheds light on the variables associated with interest in STEM teaching and provides both recent and historical empirical evidence related to interest in STEM teaching, and provides directions for future policy and research.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

CHAPTER 1: INTRODUCTION

Acknowledging the shortage of highly qualified science/mathematics (STEM) teachers, in 2010, President Obama called for preparing 100,000 new STEM teachers in the next decade (President's Council of Advisors on Science and Technology, 2010). The President's call is timely as research shows that public school enrollments are increasing (Darling-Hammond, 1998; Li, 2012; Murnane & Steele, 2007), class sizes are becoming smaller (Murnane & Steele, 2007), and a substantial proportion of teachers have begun to retire (Hanushek & Pace, 1995; Hanushek, Kain, & Rivkin, 2004; Li, 2012). All of these forces contribute to rising demand for high quality teachers (Li, 2012).[1]

Scholars have also pointed out that teacher shortages are especially acute in some subject areas (LaczakoKerr & Berliner, 2003; Ingersoll, 2007). For instance, there is a shortage of qualified secondary school teachers in subjects such as physics, chemistry, and mathematics (Darling-Hammond, 1998; Guarino, Santibanez, & Daley, 2006; Ingersoll, 2001; Ingersoll, 2007; Li, 2012). Some scholars have documented that the problem of teacher shortage in mathematics and science subjects is so acute that schools employ out-of-field teaching strategies. Ingersoll (1999) showed that about a third of all secondary school mathematics teachers had neither majored nor minored in the subject. Aforementioned findings show that a science and mathematics teacher shortage, at least in part, suggests that a small proportion of those preparing for careers in teaching have majored in mathematics/science or mathematics/science education during undergraduate years. Ingersoll (2010) argues that the problem of STEM teacher shortage is not one of

[1] Teacher quality as defined by teacher's own academic achievement and direct experience of teaching in the field they intend to teach in and the type of school they intend to teach in.

recruitment but one of retention. He also acknowledges that the rate at which STEM teachers leave is higher than the rate at which they are recruited, leaving a net deficit of STEM teachers.

In order to understand how to meet President Obama's goal, it is important to examine the current STEM teacher pipeline. ACT policy analysts (2013) showed that, of 1.3 million ACT test takers in 2012, 6 percent indicated an interest in pursuing an education major. Only 0.25 percent of the total 1.3 million expressed a desire to become a mathematics teacher and approximately 0.06 percent expressed a desire to become a science teacher. These data suggest that roughly 4,000 of ACT test takers per year now have interest in becoming STEM teachers. Of the 3 million students appearing for college entrance exams, approximately half appear for the ACT and the remaining for the SAT. Assuming that the career choices of ACT test takers are similar to SAT test takers and assuming little overlap between ACT and SAT test takers, approximately 8,000 students per year indicate an interest in pursuing a career as a STEM educator. This number falls 2,000 students short of President Obama's challenge of producing 10,000 new STEM educators a year.

In addition to meeting President Obama's call to address the issue of teacher shortage in science and mathematics subjects, there is also a need to consider the pipeline of science/ mathematics teachers for reasons of teacher quality. One of the key problems relating to teacher quality in the U.S. system is that the teaching profession consistently attracts under-prepared and academically weak individuals (Li, 2012). One study (e.g., College Board, 2008) shows that high school graduates who pursue an education major during undergraduate years have SAT scores in the bottom third of the score distribution (Li, 2012; Tucker, 2011). Their combined scores in mathematics and reading came in at 57 points below the national average (Tucker, 2011). Ingersoll and Merrill (2010) show that the academic ability of teachers is lower compared to other professions and has stayed relatively stable over the last twenty years. Other studies have shown that college graduates with higher levels of academic abilities are less likely to enter teaching, and when they do, they are far more likely to leave within the first three years of teaching (Guarino, Santibanez, & Daley, 2006; Li, 2012; Podgursky, Monroe, & Watson, 2004; Rinke, 2008).

Recruiting the most capable and committed students and preparing them to become effective teachers is both a time and resource consuming process. The President's Council of Advisors on Science and Technology (2010) defined an effective teacher as someone with deep content knowledge of the major the student intends to teach as well as at least a year of teaching experience in the subject at the type of school they want to teach in. In order to prepare students to become effective STEM teachers, identifying students interested in STEM teaching as early as their first year of college is a critical (Andrew & Schwab, 1995; Henry, Bastian, & Smith, 2012).

It is important to do this research for three key reasons. First, studies (e.g., Ingersoll, 1999) have shown that there is a dearth of STEM teachers. Ingersoll (1999) showed that less than a third of teachers teaching mathematics actually majored in mathematics themselves. He also pointed out that teacher turnover among STEM teachers is high and that schools have difficulty retaining them. These concerns are also reflected in policy, where senior policy makers have renewed call for an increase in numbers of STEM teachers. Inability to attract higher numbers of qualified candidates to STEM teaching as well as high turnover rates becomes especially problematic as policy makers raise the number of STEM teachers actually required to educate the next generation of students.

Second, there is some research examining the teacher pipeline as well as some research examining the STEM pipeline. However, studies examining the intersection of STEM and teacher pipelines is largely absent from the body of research. This absence is likely due to dearth of data that lends itself to such an analysis. Studies examining the teacher pipeline have primarily focused on a later part of the pipeline (e.g., college graduates – Flyer & Rosen, 1997 or Henke, Chen, Geis, & Knepper, 2000; teachers – Gitomer et al., 1999 or Henke et al., 2000). The one study that did look at early part of the pipeline (i.e., Hanushek & Pace's [1995] study, Who Teaches and Why, that examined academic preparation of high school students as they went through college) was conducted over 20 years ago and did not focus on STEM teachers. By contrast, there have been a number of studies conducted on the STEM pipeline (e.g., Kinzie, 2007; Sax, 1994, 1995, 2001; Sax, Jacobs, &Riggers, 2010)[2]. Yet, to the best of my knowledge no study has examined the characteristics and motivations of STEM students that have an interest to go into teaching.

Third and finally, data in this dissertation are able to shed light on the variables associated with interest in secondary school teaching among STEM students. The dataset

[2] I have reviewed the STEM pipeline literature in greater detail in Chapter 2.

includes measures of academic preparation, parental background measures, values and goals that can help understand student motivation and interest in STEM teaching better. In addition, this dissertation provides both recent and historical empirical evidence related to interest in STEM teaching. The dataset includes data starting in 1976 and until 2011. With over 30 years of data, it enables me to conduct trend analyses and makes historical interpretation of data possible, even though I am using only 1976 and 2011 data waves for logistic regression analyses. The data set includes millions of cases providing a researcher with high statistical power to conduct the analyses and draw conclusions with a greater degree of confidence.

In this dissertation, I use the widely accepted and empirically tested Social Cognitive Career Theory (SCCT) framework (Blanco, 2011; Sheu et al, 2010), shown below in Figure 1, to identify the predictors of major selection of beginning first-year undergraduate students attending four-year colleges and universities in the United States. I employ a series of binary logistic regression models to study characteristics of students who express interest in becoming STEM teachers, STEM majors, and secondary school teachers. I use the Higher Education Research Institute's (HERI) CIRP's American Freshman Survey 1976 and 2011 data waves for my analyses. I recognize that demand for majors/careers can vary over time. However, teacher shortage and teacher quality issues regarding the STEM teacher pipeline have been critical policy issues for sometime (President's Council of Advisors on Science and Technology, 2010). For the first set of analyses (i.e., recent interest in STEM teaching), I focus on 2011 data. For the second set of analyses (i.e., historical interest in STEM teaching), I use both the 1976 and 2011 data waves.

Theoretical Framework: Social Cognitive Career Theory

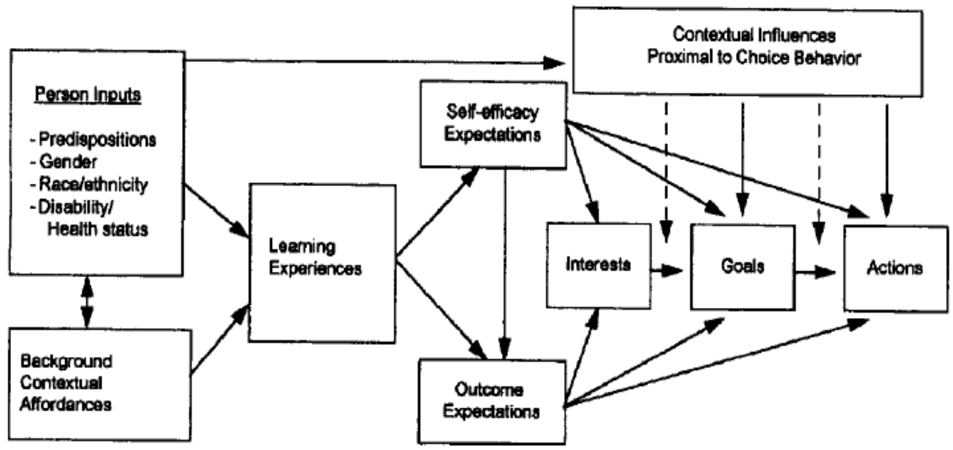

Figure 1. Model of social cognitive influences on career choice behavior. Note that dotted paths indicate moderator effects on interest-goal and goal-action relations. From "Toward a Unifying Social Cognitive Theory of Career and Academic Interest, Choice, and Performance" [Monograph], by R. W. Lent, S. D. Brown, and G. Hackett, 1994, *Journal of Vocational Behavior, 45,* p. 93. Copyright 1994 by R. W. Lent, S. D. Brown, and G. Hackett. Reprinted with permission.

SCCT offers a comprehensive theoretical framework that ties together psychological concepts that have been identified in prior literature as crucial in shaping a student's choice of major (Blanco, 2011; Brown et al, 2008; Ferry, Fouad, & Smith, 2000; Schaub & Tokar, 2005). The SCCT model explicitly incorporates individual, family, and institutional level variables (a combination of important psychological and non-psychological variables) into one model (Blanco, 2011).

The central tenets of the SCCT model focus on a set of socio-cognitive and distal variables. SCCT suggests that socio-cognitive variables (i.e., self-efficacy expectations, outcome expectations, interests and personal goals) predict student choice of major. Self-efficacy, a key construct in the SCCT model, can be defined as a student's belief in his/her ability to complete specific tasks and attain certain goals (Bandura, 1986; Bandura, 1997; Hackett, 2013). The SCCT model also predicts that distal variables (i.e., person inputs, background contextual affordances, and contextual influences) are indirectly linked to major selection via socio-cognitive variables. A full description of SCCT variables is outlined in the section below.

SCCT: Definition of Terms

The person inputs in the SCCT model primarily refer to individual personality traits and demographic characteristics (e.g., gender, race/ethnicity, religion) (Lent, et al., 2010).

Background contextual affordances refer to family-related characteristics, including parental socioeconomic variables (family income, parental education, parental occupation), neighborhood and community related variables, and even state and national level variables (Hackett, 2013).

SCCT defines learning experiences as "experiential sources of self-efficacy and outcome expectations that are shaped by person inputs and background contextual affordances" (Schaub & Tokar, 2005, p. 307).

Self-efficacy expectations can be defined as a student's belief in their ability to complete specific tasks and attain certain goals (Bandura, 1986; Bandura, 1997; Hackett, 2013). Self-efficacy is domain specific (Bandura, 1997; Smith & Fouad, 1999). For example, high level of self-efficacy in math is likely to be predictive of math performance and not of verbal/written ability (Bandura, 1997). Self-efficacy beliefs can help shape academic interests, goals, and actions. Efficacy beliefs are also important because they are associated with estimation of effort to be expended on an activity, persistence in the face of obstacles, and ultimately success (Hackett, 2013). Studies have shown that self-efficacy beliefs about mathematical or verbal/written ability can be an important predictor of choice of major (Hackett, 2013).

Outcome expectations can be described as a student's beliefs about the consequences of certain actions (Hackett, 2013). Measures of outcome expectations can include self-rated leadership ability, including the expectation of being a leader in the field, or self-rated desire to achieve. It can also include outcome expectations regarding grades in future classes, such as making a grade of B or better as used in Lent et al., 2001 and suggested in Brown et al., 2008. Expecting certain future outcomes may have consequences for present choices student makes about classes to enroll in and majors and careers to pursue.

Interests can be a reflection of a combination of variables such as a student's appraisal of their abilities (e.g., ability to influence social values, artistic abilities) and reasons for educational or occupational endeavors (e.g., reasons for attending university, drive to achieve higher status in society).

Goals can be defined as the determination to participate in certain activity and produce a desired outcome (Hackett, 2013). Goals can include variables that capture student values such as developing a meaningful philosophy of life, making a theoretical contribution to their chosen field of study, earning a lot of money, or raising a family. Goals can also reflect students' long term academic planning (e.g., highest degree planned). Some students may plan to pursue a Ph.D., whereas others may choose degrees that create pathways for occupations such as law, medicine, business, or education. Goals matter because they are the precursor to a student's outcome expectations.

SCCT conceptualizes contextual influences through three primary pathways: (1) distal or early effects on acquisition of self-efficacy beliefs and outcome expectations, (2) variables that moderate interest-choice relations, and (3) direct influences on choice (Hackett, 2013). Contextual interest variables can include the type of primary or secondary school a student attends and the characteristics of the university a student attends, such as a Minority Serving Institution (Lent et al., 2008; Lent et al., 2010), student to faculty ratio, size, distance from home, and costs of attendance.

Rationale for Using SCCT

SCCT is an appropriate framework for my study for three main reasons. First, SCCT has been extensively used to study major selection of undergraduate students (Schuab and Tokar, 2005; Lent et al., 2010; Blanco, 2011; Diegelman and Subich, 2001). SCCT has been found to be largely empirically valid across a variety of educational (e.g., Predominantly White Institution and Historically Black State Universities: Lent et al., 2013) and cultural contexts both domestically and internationally (e.g., Japan: Adachi, 2004; Italy: Lent, Brown, Nota, & Soresi, 2003; Portugal: Lent, Paixao, da Silva, & Leitao, 2010; Turkey: Ozyurek, 2005).

Second, SCCT has been used extensively to study predictors of major selection of first year STEM students at U.S. institutions specifically (e.g., engineering –Lent et al., 2003, 2005; Brown et al., 2008; Lent et al., 2013; computer science – Lent, Lopez, Lopez, & Sheu, 2008; biological or life sciences – Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010). Since this study also focuses on a subset of STEM students, it is logical to use SCCT as a conceptual framework.

Third, some scholars have argued that self-efficacy beliefs and outcome expectations are malleable and can be changed to result in different career outcomes especially among first-year college students (e.g., Brown & Lent, 1996). As such, the results from this dissertation have the potential to inform policy and practice.

CHAPTER 2: REVIEW OF LITERATURE

In this chapter, I review the literature on SCCT constructs most pertinent for this study. I discuss the constructs in the following order: person inputs (gender and race/ethnicity), background contextual affordances (family related influences – parental education, income, and occupation), learning experiences (prior academic achievement as measured by high school GPA), self-efficacy, and interests and goals (values and future degree aspirations). At the end of this chapter, I provide a summary of the literature review and synthesize five key take-aways from this chapter.

Person inputs

SCCT model asserts that person inputs can play a key role in shaping student major choice. Person inputs can include gender, race/ethnicity, and personality traits. Studies have shown that gender is highly predictive of entry into teaching. Examining the teacher pipeline, studies suggest that women are more likely than men to enter teaching (Podgursky, Monroe, & Watson, 2004; Guarino, Santibanez, & Daley, 2006). Henke, Chen, Geis, and Knepper (2000) used Baccalaureate and Beyond (B&B: 93) and analyzed longitudinal data of more than 11,000 college graduates in 1992-93. They found that women compared to men were more likely to enter teaching at each stage of the teacher pipeline (to consider teaching, to become certified to teach, to apply for teaching positions, and to actually teach in a school). However, studies have also shown that there has been a decline in women entering teaching over time (Guarino, Santibanez, & Daley, 2006) especially women with higher levels of academic achievement. Women with higher levels of academic achievement are more reluctant to enter teaching compared to men (Podgursky, Monroe, & Watson, 2004). A descriptive examination of Current Population Survey data from the 1960s to 1990 showed that nearly half of women college graduates entering teaching in the 1960s, but only about 10 percent of women college graduates in 1990, opted for careers in teaching. The authors attribute this decline to increased labor force participation of women as well as greater job opportunities for women (Ahmad, 2016; Flyer & Rosen, 1997; Guarino, Santibanez, & Daley, 2006).

In contrast to the teacher pipeline, men are much more likely to enter and persist in STEM fields with the exception of biology where women have made serious inroads (Sax, Jacobs, &Riggers, 2010). Sax, Jacobs, and Riggers (2010) also provided evidence that historically gender segregation has persisted most in STEM fields. They noted that approximately a third of women bachelor's degree holders would have to change majors in order to have a similar major distribution as men. In addition they pointed out that the index of dissimilarity declined sharply in the 1980s as well as the first half of the 1990s, but has remained relatively flat since. Regardless of whether examining teacher pipeline or STEM pipeline, gender is an important predictor and trajectories into and on the respective pipelines are gendered as well.

In addition to gender, race/ethnicity can be an important person input as well. Studies suggest that white women enter teaching at higher rates compared to white men. White women also enter teaching at higher rates compared to both men and women from racial and ethnic minority groups including those that identify as African American, Hispanic, or Asian (Guarino, Santibanez, &Daley, 2006).

Race/ethnicity is an important predictor of entry into STEM pipeline though in ways different from the teacher pipeline. White and Asian students are more likely to enter STEM fields compared to Hispanic and African American peers (Sax, Jacobs, & Riggers, 2010). Sax, Jacobs, and Riggers (2010) pointed out that the racial/ ethnic gap in STEM majors is narrowing. Finally Sax, Jacobs, and Riggers(2010) pointed out that despite the finding that gender was a significant predictor in their models, race/ ethnicity continued to be an important predictor as well and therefore should be taken into account when studying student's major selection. In short, race/ ethnicity is an important predictor of entry into both the teacher as well as the STEM pipelines.

Some studies have analyzed the role of person inputs using the SCCT model specifically (e.g., Ferry, Fouad, & Smith, 2000; Schuab & Tokar, 2005). Schaub and Tokar (2005) examine the relationship of person inputs to learning experiences and the relationship of learning experiences to self-efficacy and outcome expectations. Their sample consisted of 327 students (209 women and 118 men) at a private mid-Atlantic university, including students from 55 different majors categorized into 10 academic areas (Music; Business/Marketing; Cultural Studies; Economics/Political Economy; English/History; Government/Policy; Languages/ Linguistics; Mathematics/Science; Social Sciences; Undecided/Undeclared/Missing). The sample was comprised of 20.2 percent first year students, 72.8 percent upper-class students, and 4.6 percent graduate students. They used the Learning Experiences Questionnaire created by Schaub (2004) for measuring learning experiences (e.g., ‘‘while growing up, I recall seeing people I respected reading scientific articles,’’ p. 311) and Occupational Outcome Expectations created by Gore and Leuwerke (2000) for measures of outcome expectations. Schuab and

Tokar (2005) found that the association of personality traits with occupational interests was at least partially mediated through learning and socio-cognitive mechanisms. They also found that learning experiences were positively associated with self-efficacy beliefs and outcome expectations. Their findings indicated general support for SCCT's claim that personality is associated with learning experiences and that learning experiences are positively related to self-efficacy and outcome expectations.

Background contextual affordances

Family and peer-related characteristics are also important distal variables according to SCCT (Lent et al., 1994; Ferry, Fouad, & Smith, 2000) and as demonstrated in prior research. Ferry, Fouad, and Smith (2000) gathered data from 791 undergraduate psychology students attending two mid-western universities. The sample consisted of predominantly first-year (73 percent), white (85 percent), and female (71 percent) students. Ferry and colleagues operationalized family-related characteristics using measures of parental involvement, parental encouragement, parental style, and parental mathematics/science proficiency. They found that parental encouragement in science/mathematics was positively and statistically significantly associated with learning experiences. Moreover, learning experiences were significantly associated with self-efficacy and outcome expectations. Their study suggests that parental verbal reinforcement of children's science/mathematics performance and parental encouragement were positively associated with students' outcome expectations. The results of their study lend support to the SCCT hypothesis that distal variables broadly and family related factors specifically can be important in shaping students choice of major.

Parental socio-economic variables (defined as parental income, parental education, and parental occupation) are also distal variables in the SCCT framework. Sociological research has established positive links between parental income and college enrollment as well as baccalaureate degree attainment (e.g., Astin & Oseguera, 2004; Conley, 2001; Ishitani, 2006; Levy & Duncan, 2000; Mayer, 1997).

Some research has also linked parental income specifically to student's choice of major (e.g., Davies & Guppy, 1997; Dawson-Threat & Huba, 1996; Green, 1992; Trusty, Robinson, Plata, & Ng, 2000; Ware & Lee, 1988; Ware, Steckler, & Leserman, 1985). Studies have shown that higher parental income is associated with higher likelihood of students entering STEM majors (Davies & Guppy, 1997; Trusty, Robinson, Plata & Ng, 2000) and some studies (e.g., Trusty, Robinson, Plata, & Ng, 2000) have shown that the association between parental income and choice of STEM majors is stronger for women than men. Higher levels of parental income were also linked to lower probability of student's entry into education majors (Trusty, Robinson, Plata, & Ng, 2000).

Ware and Lee (1988) found that men from higher SES backgrounds had higher likelihood of majoring in science relative to other men. A later study by Leppel, Williams, and Waldauer (2001) found similar results. Using nationally representative Beginning Post-secondary Students Study (BPS: 90), Leppel, Williams, and Waldauer (2001) found that men regardless of socio-economic background were more motivated by money and status in selecting a major. The authors highlighted that better monetary outcomes were also important for women from less affluent backgrounds arguing that women from wealthier backgrounds may have felt more secure and willing to explore majors which are not necessarily high-paying (in monetary terms). The findings suggest that the association between SES and choice of major may be contradictory for women from high SES backgrounds. While men from higher income backgrounds are more likely than other men to major in science, women from higher income backgrounds may be as likely to pursue hard sciences as education.

Fewer studies have examined links between parental education or parental occupation and a student's choice of major. One relevant study (Ware et al., 1985) examining links between parental education and choice of major was published almost three decades ago. Whether the findings are still applicable remains to be seen. Ware et al. (1985) (without controlling for income) found that daughters of highly educated parents were more likely to choose a major in science compared to other women in the sample. The authors attributed this finding to the fact that highly educated parents may (presumably) be able to afford education advantages, for example special tutoring, summer enrichment programs, and high quality academic environments for each of their children. Highly educated parents may also be more willing to encourage and support their daughters into non-traditional pursuits such as majoring in hard sciences (e.g., physics, mathematics, computer science). The authors noted that it is possible that highly educated parents have less conventional ideas about appropriate behaviors for their daughters and therefore willing to encourage their daughters into nontraditional majors and career paths. These findings show that parental education matters and provides a starting point to think about the association between parental education and choice of major.

Few studies have examined the relationship between parental occupation and student choice of major. Leppel, Williams, and Waldauer (2001) study was an exception in that it incorporated aggregate measures of socio-economic variables in their examinations of student's choice of major. They found that both male and female students with fathers in professional or executive occupations (measured as individual variables and not composite measures) were more likely (compared to other male and female students in the sample) to choose a major in science or engineering. Moreover, female students with mothers who were in executive or professional occupations (compared to other female students in the sample) were less likely to major in education. This finding shows that parental occupation matters and is an important predictor for examining student's choice of major.

Learning experiences

SCCT asserts that learning experiences (e.g., prior performance accomplishments) play a key role in shaping major choice. Consistent with SCCT, prior academic preparation constitutes one of the ways to examine learning experiences. The most recent study analyzing academic preparation of students interested in entering elementary and secondary teaching was Hanushek and Pace's (1995) study "Who Chooses to Teach and Why?", approximately 20 years ago. The study examined the decision to enter teaching as a series of sequential steps. The authors suggested that the process started with initial aspirations and career goals of high school students and changed as students went through college. They were able to identify students that ended up fully prepared to teach versus other students with an interest in teaching. They used longitudinal data from High School and Beyond (HSB) survey focusing on a group of high school seniors in 1980 and who were followed every two years until 1986. They shared three reasons why HSB was an appropriate dataset for the study. First, its longitudinal design allowed them to follow the same student through college and observe whether or not the student was preparing for a career in teaching and finished teacher training. Second, its large sample offered information about the variation in certification requirements across states as well as rewards for teaching. Third, the data set included a measure for standardized achievement tests providing the researchers with a rough measure teacher quality. The study found that lower ability students as measured by standardized achievement tests were more likely to enter teaching. They also found that White women were more likely than men to finish teacher preparation programs compared to White men. White women were also more likely to finish teacher preparation compared to both men and women from various racial and ethnic minority groups. One of the limitations of the study was that it did not disaggregate between those interested in becoming elementary school teachers versus secondary school teachers, even though studies have shown that the lower ability finding disappears once elementary school teachers are accounted for (Guarino, Santibanez, & Daley, 2006). While several later studies (e.g., Gitomer et al., 1999; Henke et al., 2000; Podrusky, Monroe, & Watson, 2004) examined the academic preparation of those in the teaching profession, none examined them as early in the pipeline as Hanushek and Pace (1995). Some of these later studies (e.g., Gitomer et al., 1999; Podrusky, Monroe, & Watson, 2004) examined elementary and secondary school teachers separately and two showed that the lower ability finding disappears when we examine secondary school teachers and remove primary school teachers from the sample.

Studies examining academic preparation of students interested in pursuing or enrolling in STEM majors have suggested that STEM majors have higher grades in high school than other students (Green, 1989; White, 1992; Sax, Jacobs, & Riggers, 2010). Studies have also shown that women tend to have higher high school grade point averages than men (Sax, 1994; Sax, 2001; Sax, 2008). Other studies have shown that women's higher high school grade point averages facilitated their entry into STEM fields though their lower academic self-assessments especially in mathematics acted as a barrier and limited their entry and progression into STEM majors (Sax, Jacobs, & Riggers, 2010). Some studies also showed that women have lower self-confidence and that many women who left STEM fields before earning STEM degrees had higher grades than men that persisted (Zhao, Carini, & Kuh, 2005). In summary, prior academic achievement may or may not be lower in case of secondary school teachers; there is evidence (e.g., Sax, Jacobs, & Riggers, 2010) that suggests that STEM majors tend to have higher prior academic achievement compared to non-STEM majors. An examination of both the teacher pipeline and the STEM pipeline suggests that prior academic achievement is a key predictor of student's choice of major.

Self-efficacy

Empirical research lends support to the SCCT assertion that a student's choice of major is predicted by the key core variable, self-efficacy (Brown et al., 2008; Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010; Lent et al., 2003, 2005; Lent, Lopez,

Lopez, & Sheu, 2008; Lent et al., 2013). The basic premise of the SCCT is that self-efficacy is associated with outcome expectations; self-efficacy and outcome expectations are both pre-cursors of interests; and interests, self-efficacy, and outcome expectations are jointly associated with major choice goals (Lent et al., 2008). Students with stronger self-efficacy beliefs and positive outcome expectations will tend to set and work toward more challenging academic goals compared to those with weaker self-efficacy beliefs and less positive outcome expectations (Brown et al., 2008). Studies have also consistently shown that self-efficacy expectations in the domain of mathematics are linked to a student's selection of science/mathematics-based versus non-science/mathematics based college majors: the stronger the mathematical self-efficacy expectations, the higher the likelihood that students select science/mathematics-based majors (Ferry, Fouad, & Smith, 2000). Researchers have also acknowledged that, if SCCT has to be used to study a wider range of subjects (beyond STEM subjects), then there is a need to introduce other measures of self-efficacy beyond mathematical self-efficacy (e.g., verbal or written self-efficacy) into statistical models (Schaub & Tokar, 2005; Smith & Fouad, 1999).

There is a dearth of literature on early teacher pipeline that examines self-efficacy beliefs. Some studies have examined the relationship between self-efficacy and interest in STEM majors. For instance, Kinzie (2007) used discriminant analyses and analyzed NELS:88 data. The author traced a cohort of 3,148 female students from 8^{th} grade to 12^{th} grade and found that both prior academic achievement (e.g., math and science grades) and beliefs about ability were important predictors of interest in STEM majors. In a later study Sax, Jacobs, and Riggers (2010) pointed out that even after controlling for academic achievement women tended to rate their abilities lower than men, and therefore self-efficacy remained an important predictor in their models. Thus, in addition to prior academic achievement, self-efficacy is likely to be an important predictor of student's interest in teacher pipeline as well as the STEM pipeline.

Interests and goals

When examining the teacher pipeline, studies have suggested that interests and goals can play a key role (Guarino, Santibanez, & Daley, 2006). Frakas, Johnson, and Foleno (2000) used nationwide data from 660 public school teachers with 5 years of teaching experience or less and showed that 81 percent of the teachers deemed that it was extremely important for their job role to allow time for raising family and 72 percent deemed it critical that the job contribute to society. In another survey of 802 college graduates under 30 years of age that were not teaching, Frakas, Johnson, and Foleno (2000) shared that 70 percent shared that making a difference in the life of at-risk students mattered to them greatly, 55 percent shared that they would consider teaching if they could do so without having to go back to school, and 47 percent shared that they would consider teaching if it paid more.

Other studies have shown that education majors placed greater emphasis on wanting to contribute to society whereas non-education majors placed greater emphasis on salary, prestige, job security, and advancement opportunities (Shipp, 1999; Guarino, Santibanez, & Daley, 2006). It is important to note that results from Shipp (1999) are based on a small sample of 263 African American college students at two different universities in 1992. In addition, an exploratory survey of 41 beginning African

American teachers at one higher education institution cited the potential contribution of teaching to the betterment of society as well as the opportunity to be creative as important reasons for interest in teaching over salary, autonomy, and prestige (King, 1993; Guarino, Santibanez, & Daley, 2006). The interests also differed by gender in the sample. Higher shares of men than women reported that salary, autonomy, or prestige were more important reasons; women reported vacation time and time to raise children as important motivators. Nonetheless, given the small sample size of Shipp's study, it is difficult to generalize these findings to all education students or even to all African American education students (Guarino, Santibanez, & Daley, 2006). Sax, Jacobs, and Riggers (2010) pointed out that examining goals such as salary, prestige, or wanting to contribute to society can be important in understanding STEM student motivations as well. In summary, interests can be important predictors of choice of major.

SCCT suggests that future goals such as degree aspirations are critical in understanding student choice of majors. Though under examined in both the teacher pipeline as well as STEM pipeline literature, it can be insightful to understand student choice of major vis-à-vis their highest degree aspirations (e.g., a medical degree, a non-medical masters, or a doctoral degree). Medical degree aspirations can be important as a possible career path especially for STEM students. US News in 2013 reported that 51 percent of students who enrolled in medical schools in the US majored in biological sciences. The remaining 49 percent of medical students majored in mathematics or statistics, physical sciences, specialized health sciences, social sciences or humanities (Chang, 2013).

Summary of Literature Review

Several conclusions may be drawn from this review of literature. First, throughout the review while I discussed pertinent findings from the teacher pipeline and the STEM pipeline, there is a dearth of literature at the intersection of these two literatures, both in the recent past (e.g., 2011) as well as over time (e.g., comparison between 1976 and 2011). An examination of interest in STEM teaching should begin with identifying the proportion of STEM majors interested in secondary school teaching as well as identify the proportion of those interested in becoming secondary school teachers and majored in STEM subjects.

Second, research examining the person inputs (e.g., gender and race/ethnicity) provides consistent findings. Women are more likely than men to enter teaching and less likely to enter STEM fields (with the exception of biology) (Guarino, Santibanez, & Daley, 2006; Sax, Jacobs, & Riggers, 2010). Alternatively, gender composition in STEM fields as well as among teachers is highly skewed and therefore there is reason to suspect that paths into STEM teaching may differ between male and female students. Including gender interactions in analyses can shed some light on these differing paths into STEM teaching. With regard to race/ethnicity, by and large, those who identify as racial and ethnic minorities are less likely to enter teaching as well as less likely to enter STEM fields (Guarino, Santibanez, & Daley, 2006; Sax, Jacobs, & Riggers, 2010). The relationship between person inputs (e.g., gender and race/ethnicity) and STEM student's interest in teaching careers requires additional attention, both in models examining recent data as well as models examining changes over time.

Third, background contextual affordances, particularly parental income, education, and occupation, are also associated with student's choice of major. Studies suggested that parental income is positively associated with entry into STEM majors (Davies & Guppy, 1997; Trusty, Robinson, Plata, & Ng, 2000) and negatively associated with entry into education majors (Trusty, Robinson, Plata, & Ng, 2000). Studies also suggested that men are more likely than women to be motivated by money and status in selecting a major (Leppel, Williams, & Waldauer, 2001) and that men from higher income backgrounds compared to men from lower income backgrounds are more likely to pursue science majors (Ware & Lee, 1988) whereas studies indicate contradictory findings for women. Women with highly educated parents are more likely than other women to major in science (Ware & Lee, 1985). When examining parental occupation and student's choice of major, studies (e.g., Leppel, William, & Waldauer, 2001) suggest both male and female students with fathers in professional or executive occupations are more likely to major in science and engineering. Female students with mothers in professional and executive occupations are less likely to major in education (Leppel, Williams, & Waldauer, 2001).

Nonetheless, several studies of parental background are fairly dated raising questions about their continued relevance. In addition, while some studies have examined the associations between parental education, income, occupation and choice of majors (e.g., Leppel, Williams, & Waldauer, 2001), there is a dearth of studies examining these associations for STEM students interested in teaching careers, both recently and over time. Moreover, prior research shows that parental background variables matter in differing ways based on the gender of the parent as well as gender of the child (e.g., Leppel, Williams, & Waldauer, 2001). Yet there is dearth of studies examining occupational inheritance over time (most likely due to dearth of data over time). Therefore, any analyses that can shed light on these relationships are highly warranted.

Fourth, learning experiences and self-efficacy form the core of SCCT and have been consistently found to be important predictors of student choice of major (e.g., Lent et al., 2013). Hanushek and Pace (1995) study found that students with lower standardized achievement test scores were more likely than other students to enter teaching. Guarino, Santibanez, and Daley (2006) pointed out (that in two studies out of four) this relationship disappears when examining secondary school teachers. Studies examining academic preparation of students interested in pursuing or enrolled in STEM majors have suggested that STEM majors have higher grades in high school compared to other students (Green, 1989; White, 1992; Sax, Jacobs, & Riggers, 2010). Prior academic achievement (e.g., high school grades) of STEM students interested in teaching careers remains to be examined.

Few studies have examined self-efficacy beliefs of students interested in teaching careers. Studies have shown that students with higher self-efficacy in mathematics tend to choose science and mathematics based majors at higher rates than other students (Ferry, Fouad, & Smith, 2000). Other studies (e.g., Kinzie, 2007) show that STEM students have higher self-efficacy than other students. Studies (e.g., Sax, Jacobs, & Riggers, 2010) also share that women consistently rate their abilities lower than their actual abilities whereas men rate their own abilities higher than their actual abilities. These findings point to the need to incorporate gender interactions in logistic regression models with both recent data as well as over time. In summary, both prior academic achievement and self-efficacy beliefs are important predictors of student's choice of major and should be included in models examining the choice of STEM students interested in teaching careers.

Fifth and finally, interests and goals are important predictors of student choice of majors. Studies have shown that education majors placed greater emphasis on raising a family, wanting to contribute to society whereas non-education majors placed greater emphasis on salary, prestige, job security, and advancement opportunities (Guarino, Santibanez, & Daley, 2006). Sax, Jacobs, and Riggers (2010) pointed out that examining goals such as salary, prestige, or wanting to contribute to society can be important in understanding STEM student motivations as well. Therefore interests and goals are likely to be key in examining differences among STEM majors, STEM students interested in teaching careers, and those that are interested in secondary school teaching careers. Examining student highest degree aspirations namely pursuing a medical degree, a non-medical masters, or a doctorate, may also predict student's choice of majors as well. Students interests and goals can vary by gender and therefore it is important to incorporate gender interactions in models using recent data, and three way interactions between variable, gender, and time for models over time (if data permits).

CHAPTER 3: RESEARCH DESIGN

This study uses descriptive and binary logistic regression analyses to examine the extent to which variables proposed in the SCCT explain entering college students' choice of major, namely: STEM major (non-teaching), STEM teaching, and secondary school teaching. The specific independent variables included in the models that pertain to SCCT constructs are person inputs, background contextual affordances, learning experiences, self-efficacy, outcome expectations, and interest and personal goals. The study addresses the following set of research questions:

Research Questions Set # 1

1) What proportion of STEM majors indicate an interest in becoming STEM teachers? What proportion of students who are interested in becoming secondary school teachers is STEM majors? Do the proportions differ by gender?
2) How do the characteristics of first-year students attending four-year colleges who indicate interest in a STEM teaching career compare with the characteristics of students who indicate interest in STEM major and the characteristics of students who indicate interest in secondary school teaching? Do these characteristics differ by gender?
3) What are the predictors of indicating interest in a STEM teaching career rather than an interest in STEM major? What are the predictors of indicating interest in STEM teaching career rather than interest in secondary school teaching? Do these predictors vary by gender?

a) Do person inputs differ between prospective STEM teachers and prospective STEM majors? How do they differ in terms of gender and racial/ethnic composition? What about prospective STEM teachers and prospective secondary school teachers?

b) Do background contextual affordances differ between prospective STEM teachers from prospective STEM majors? How do they differ in terms of parental education, parental income, and parental occupation? What about prospective STEM teachers and prospective secondary school teachers?

c) Do learning experiences and self-efficacy differ between prospective STEM teachers and prospective STEM majors? How does high school performance and mathematical self-efficacy compare for prospective STEM teacher majors and prospective STEM majors? What about prospective STEM teachers and prospective secondary school teachers?

d) Do interests differ between prospective STEM teachers and prospective STEM majors? Are STEM teachers less interested in making money and more interested in helping others compared to other prospective STEM majors? Are STEM teachers less interested in making a theoretical contribution to science and more interested in raising a family compared to other prospective STEM majors? What about prospective STEM teachers and prospective secondary school teachers?

e) Do goals differ between prospective STEM teachers and prospective STEM majors? How do they differ in terms of degree aspirations? Are STEM teachers more or less likely to plan a doctoral degree, a medical degree, or a non-medical master's degree? What about prospective STEM teachers and prospective secondary school teachers?

Research Questions Set # 2

4) What proportion of STEM majors was STEM teachers in 1976 and in 2011? What proportion of secondary school teachers was STEM majors in 1976 and 2011? What are the trends over time?

5) How have the characteristics of students with these three interests (STEM teaching, STEM major, secondary school teaching) changed over time? Specifically, how do they differ between 1976 and 2011?

6) How do the predictors of indicating interest in a STEM teaching career rather than an interest in STEM major change over time? How do the predictors of indicating interest in STEM teaching career rather than interest in secondary school teaching change over time?

Research Questions Set # 3

7) Does the association between parental occupation and students career intention to pursue

STEM teaching vary over time based on gender of parent and gender of the student? How has this relationship varied over time (1976 and 2011)? For example, does a father with an occupation in STEM fields have more (or less or no) influence on his son's decision to pursue STEM teaching in 2011 compared to father-son pair in 1976?

This study assumes that students choice of major as they begin their first year of college is an important point in the teacher and STEM education and career pipelines. The study also implicitly assumes that their choice of major and occupation in their first year of college is a reasonable proxy of their major and occupation after graduation. While some studies have suggested that choice of major in the first year of college is the single most important predictor of major at graduation and subsequent occupation after graduation (e.g., Dawson-Threat & Huba, 1996; Leppel, Williams, & Waldauer, 2001), other studies have suggested that major and occupational plans change over time (e.g., Malgwi, Howe, & Burnaby, 2005). A preliminary analysis of Beginning Postsecondary study (BPS) 2003-09 data suggests that 46.7 percent of those that majored in education in their first year of college graduated with an undergraduate degree in education and approximately 33.0 percent of STEM majors graduated with an undergraduate degree in STEM.

Data and Sample

This dissertation uses a dataset created by University of California, Los Angeles, Higher Education Research Institute CIRP Freshman Survey data team. The dataset is made up of five data waves (1976, 1986, 1996, 2006, and 2011) though I only use 1976 and 2011 data waves, with data collected through separate surveys. Each survey employed a two-stage stratified sample in which institutions were first selected, and then beginning first year students within these institutions were selected. See Table 1 for institutions. In each wave, participants were surveyed during registration, freshman orientation and the first few weeks of classes (Pryor et al., 2012). The normed sample includes only institutions with a survey response rate of 65 percent or higher (Pryor et al., 2012). The CIRP team provided two data sets namely one with raw data and a smaller dataset with weighted data. The CIRP team also created and applied separate weights for each cohort using IPEDS data in the smaller dataset. It is the smaller weighted dataset that I used for the analyses outlined here. The weighting scheme, as outlined in Pryor et al. (2012), used institutional control, institution type, institutional selectivity, and enrollment to create a nationally representative sample of beginning first-year students at four-year higher education institutions in the United States. Details regarding sampling are also available in Pryor et al. (2012).

Table 1: Number of institutions included in each data wave

		Predominantly White Institutions		Historically Black Colleges and Universities
	Total	Universities	4 year institutions	
1976	1532	190	1257	85
2011	1580	-[3]	-	-

Source: http://heri.ucla.edu/#

The institutions in the sample were four year colleges and universities in the United States. Of the institutions in my sample, approximately 45.2 percent were universities and 54.8 percent were colleges. In addition, 29.4 percent identified as a religious institution and 70.6 percent did not. About 43.7 percent of institutions were public institutions and 56.3 percent were private institutions. Finally, 3.6 percent of the institutions were HBCUs and 96.4 percent were not.

[3] I had asked for details of 2011 data and the response I got is that there were 1580 institutions but that the breakdown was unavailable. I was not given a reason.

The surveys asked questions about the students social background, attitudes, prior educational achievement, values, and future goals (Sax, Jacobs, & Riggers, 2010). The wide variety of questions asked in the survey offers researchers a unique opportunity to examine the predictors of major selection and occupational intention. The survey questions drawn upon in this study have not changed over time.

The sample for this study is limited to first-time, beginning first-year students who entered four-year institutions in the United States. The analytic sample includes individual level responses from 1,640,451 first-time, full-time (FTFT) students (Pryor et al., 2012). The 1,640,451 is the total number of cases in my dataset for all years in the dataset i.e. 1976, 1986, 1996, 2006, and 2011. The first data wave in 1976 includes 328,950 cases and the final data wave in 2011 includes 267,984.

Variables

I used data from two CIRP questions regarding students "probable major" and "probable career occupation" to create the two primary dependent variables of interest for this study. Both of these questions have been asked in the same way in each data wave starting in 1976 and up until 2011. The first dependent variable has two categories: STEM teacher versus STEM major. The second dependent variable also has two categories: STEM teachers versus secondary school teachers. If I structured the dependent variable as a 3 category multinomial logit, the analyses would break down due to quasi separation, especially when examining historical data in 1976 and 2011. Quasi-separation occurs when analysis breaks down due to encountering an empty cell. Quasi separation renders the results from the multinomial logit analyses as invalid. Therefore, I used binary logistic regression instead of multinomial logistic regression. STEM students, for the purposes of this study, include those that intend to major in Physics, Chemistry, Biology, and Mathematics. Studies (e.g., Ingersoll, 1999) highlight science and mathematics teacher shortage and aforementioned subjects qualify. Table 2(a) shows the number of cases in each category and suggests that there is sufficient power to conduct the binary logistic regression analyses. Table 2 (b) provides number of cases in logistic regression analysis as well as provides percentage of missing data.

Table 2 (a): Number of students in each data wave

Data wave	STEM majors	STEM teachers	Secondary school teachers	Total number of students in data wave for full sample
1976	63,433	821	9,839	74,093
2011	59,711	609	6,493	76,473
Total	123,144	1,430	15,332	
			Total: 139,906	**Full sample total**: 150,566

Source: HERI dataset

Table 2(b): Number of cases in logistic regression analysis and missing data

Data wave	STEM majors versus STEM teachers	STEM teachers versus secondary school teachers
2011	44,531 Total cases: 60,320 = 59,711+609 Missing data: 1 – (44,531/60,320) = 26%	4,901 Total cases: 7,202 = 6,493+609 Missing data: 1 – (4,901/7,202) = 32%
1976 and 2011	86,984 Total cases: 124,584 = 123,144+1,430 Missing data: 1 – (86,984/124,584) = 30%	11,314 Total cases: 16,762 = 5,332+1,430 Missing data: 1 – (11,314/16,762) = 32.5%

Source: HERI dataset

Several of the independent variables used in this study have been previously identified in the literature as important predictors of major choice (e.g., Ferry, Fouad, & Smith, 2000; Lent et al.,2001, 2003, 2005; Lent, Lopez, Lopez, & Sheu, 2008). Figure 2 lists the variables measuring the SCCT constructs in this study. Figure 2 organizes the various measures into conceptual groups but is not intended to suggest that I will conduct analyses (e.g., path analyses) to revalidate a model that has already been validated by researchers (e.g., Lent et al. 2001). Table 3 provides a full description of all variables and scales included in the analyses.

Person Inputs are measured by indicators of gender and race/ethnicity. Background Contextual Affordances are defined as parental socio-economic status and measured by indicators of parental education, parental occupation, and family income. Parental income rather than student's income is an appropriate measure for this sample because approximately 99 percent of students in the 2006 and 2011 data waves were traditional age college students, 19 years or younger. When examining the age of students for the full sample from 1976 to 2011, parental income is still an appropriate measure, given that approximately 95 to 99 percent of the students were 19 years or younger.[4] I operationalized parental occupation through measures specific to disciplines – father has a STEM occupation, mother has a STEM occupation, father is a secondary school teacher, or mother is a secondary school teacher. Ongoing research by Jacobs, Ahmad, and Sax (2016) suggests that parental occupation is positively associated with their offspring's interest in that occupation.

---

[4] In 1976 97.8 percent, 1986 95.7 percent, 1996 94.6 percent, 2006 98.6 percent, and in 2011 98.7 percent students included in this sample were 19 years of age or younger.

Learning experiences have been often operationalized as measures of past performance (e.g., high school GPA, SAT/ACT score). It would be helpful to have other indicators of learning experiences, perhaps one that capture behaviors rather than achievement scores. With that said, High school GPA, SAT/ACT have been used as measures of learning experiences in other studies (e.g., Sax, Jacobs, & Riggers, 2010) and are the best measures I have in my dataset.

Therefore, I used high school GPA as the measure in this study because prior literature (e.g., Sax, Jacobs, & Riggers, 2010) has shown it to be a reliable predictor of interest in STEM majors. In addition GPA had fewer missing cases for this measure (under 10 percent) than for SAT score (about 53.5 percent). I use measures of self-rated mathematical ability as a measure of mathematical self-efficacy. Several SCCT studies have identified self-efficacy as a key predictor of student choice as well as emphasized the need to consider mathematical self-efficacy (Schaub & Tokar, 2005; Hackett, 2013).

Consistent with prior research (Lent et al., 2001; Brown et. al, 2008), outcome expectations are measured by a student’s expectation to earn at least a ‘B’ in their courses and be a leader in the chosen field. Interests and goals have been identified as important predictors in previous literature (Lent et. al, 2001; Hackett, 2013) as well. I included measures of desire to contributing to society and helping others, the desire to raise a family, and the desire to make more money and strive for higher status in society. I operationalized goals by including measures of students’ highest degree planned: a medical degree, a PhD, or a non-medical master’s degree. I operationalized interest using scales such as the extent to which a student identifies with artistic endeavors, identifies with being a scholar, or a social activist. The scales were constructed by the UCLA CIRP research team that provided the data set.[5]

I also incorporate measures of contextual influences proximal to choice variables. These are context or structural variables (e.g., institutional characteristics) that indirectly shape student's choice of major or career. Since the sample is comprised of students beginning their postsecondary education, the influence of institutional characteristics is minimal on their major and career choices at that stage. I include institutional measures in order to take into account the self-selection into certain types of higher education institutions and how that is linked to student decision making around major and career choices. For instance, data that shows whether the institution student is selecting into has a strong school of education or reputation for producing educators gives some indication of the strength of student's interest in the field (J. Kochanek, personal communications, 18 February, 2015). Similarly choosing institutions with strong science and engineering programs can also serve as an indication of how students are thinking about future career trajectories. Unfortunately the HERI data does not include such nuanced measures. As the closest proxy, I have used institutional characteristics and region to give some indication of the type of institutions students are choosing to select.

[5] The UCLA CIRP data team created scales outlined in Table 3. The scales were created using item response theory. The full process is described in the following links: http://www.heri.ucla.edu/PDFs/constructs/technicalreport.pdf and http://www.heri.ucla.edu/PDFs/constructs/Appendix2011.pdf

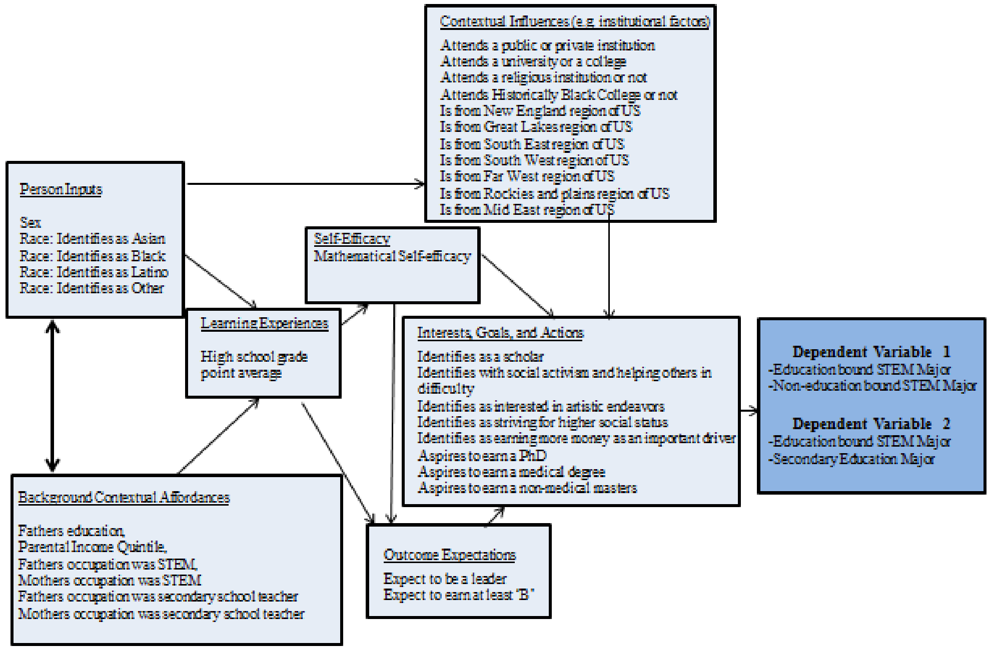

Figure 2: Conceptual model depicting the grouping of variables in the study

Table 3: Definitions of independent variables for predicting major/career choice

Variables	Type of variable	Description/Definition
Dependent Variable (DV)		
DV1: STEM Teacher versus STEM major	Nominal	Student identifies as a STEM teacher (1/0) with STEM majors as comparison group
DV2: STEM Teacher versus secondary school teacher	Nominal	Student identifies as a STEM teacher (1/0) with secondary school teachers as comparison group
Independent Variables (IV)		
Personal Inputs		
Sex	Nominal	Student identifies as female (1/0)
Race: Identifies as Asian	Nominal	Student identifies as an Asian (1/0)
Race: Identifies as Black	Nominal	Student identifies as Black (1/0)
Race: Identifies as Latino	Nominal	Student identifies as Latino (1/0)
Race: Identifies as belonging to other race	Nominal	Student does not identify as an Asian, Black, Latino or White. The variable also captures students that identify as belonging to two or more races (1/0)
Race: identifies as White (omitted category)	Nominal	Student identified as White (1/0)
Parental Background Characteristics		
Father's Education	Nominal	Father's Education 1: Grammar school or less 2: Some high school 3: High school graduate 4: Post-secondary school other than

		college 5: Some college 6: College degree 7: Some graduate school 8: Graduate degree
Parental Income Quintile	Nominal	Parent's Income Quintile 1: First quintile 2: Second quintile 3: Third quintile 4: Fourth quintile 5: Fifth quintile
Fathers Occupation is STEM	Nominal	Father occupation is STEM (1/0)
Mothers Occupation is STEM	Nominal	Mother occupation is STEM (1/0)
Fathers occupation is secondary school teaching	Nominal	Father occupation is secondary school teaching (1/0)
Mothers occupation is secondary school teaching	Nominal	Mother is employed is secondary school teaching (1/0)
Learning Experiences		
High school grade point average	Nominal	High School Grade Point Average 1: D, 2: C, 3: C+, 4: B-, 5: B, 6: B+, 7: A-, 8: A or A+
Self-rated Ability		
Self-rated Mathematical Ability	Nominal	Self-rated Mathematical Ability 1: Lowest 10% 2: Below average 3: Average 4: Above Average 5: Highest 10%
Outcome Expectations		
Expect to be a leader	Scale	The scale was created by combining three variables namely self-rated leadership ability, self-rated self-confidence (social) and self-rated drive to achieve (Eagan, 2013).

Expect to make at least a 'B' Average	Nominal	Expect to make at least a 'B' average 1: No chance 2: Very little chance 3: Some chance 4: Very good chance
Goals and Interests		
Interests and goals: Developing a meaningful philosophy of life	Nominal	Developing a meaningful philosophy of life 1: Not important 2: Somewhat important 3: Very important 4: Essential
Interests and goals: Making a theoretical contribution to science	Nominal	Making a theoretical contribution to science 1: Not important 2: Somewhat important 3: Very important 4: Essential
Interests and goals: Raising a family	Nominal	Raising a family 1: Not important 2: Somewhat important 3: Very important 4: Essential
Scholar	Scale	The scale was created by combining three variables namely self-rated academic ability, self-rated self-confidence (intellectual), and self-rated writing ability (Eagan, 2013).
Social activism and helping others in difficulty	Scale	The scale was created by combining five variables namely self-rated goal of influencing social values, participating in community action program, helping others in difficulty, influencing political structure, and becoming involved in programs to clean-up environment (Eagan, 2013).

Interested in artistic endeavors	Scale	The scale was created by combining four variables namely self-reported goal of creating artistic work (e.g. painting, sculpture), self-rated artistic ability, self-reported goal of creating original works (e.g. writing novels, poems), and self-reported goal of becoming accomplished in one of the fine arts (e.g. acting, dancing) (Eagan, 2013).
Striving for higher social status	Scale	The scale was created by combining five variables namely self-reported goal of obtaining recognition from my colleagues for contribution to my special field, self-reported goal of being well-off financially, self-reported goal of having administrative responsibilities for others work, self-reported goal of becoming authority in my field, and self-reported goal of becoming successful in a business of my own (Eagan, 2013).
Intrinsic reasons for pursuing education	Scale	The scale was created by combining three variables namely self-reported reason for attending university was to gain general education and appreciation of ideas, self-reported reason for attending university was to become a more cultured person, and self-reported reason for attending university was to learn more about things that interested the particular student (Eagan, 2013).
Extrinsic reasons for pursuing education	Scale	The scale was created by combining two variables namely the self-reported reason to attend university was to be able to get a better job and the other self-reported reason was to be able to make more money (Eagan, 2013).

Contextual Influences		
Type of educational institution	Nominal	Type of educational institution 1: University 0: College
Type of religious institution	Nominal	Type of religious institution 1: Religious College/University 0: Non-sectarian
Attends Historically Black College	Nominal	It is an Historically Black College or not 1: HBCU 0: not HBCU
It is a public or a private institution	Nominal	It is a public or a private institution 1: Public 0: Private
Institution is in New England region	Nominal	Region in North East i.e. New England (1/0)
Institution is in Great Lakes region	Nominal	Region is Great Lakes (1/0)
Institution is in South East region	Nominal	Region is Southeast (1/0)
Institution is in South West region	Nominal	Region is Southwest (1/0)
Institution is in Far West region	Nominal	Region is Far West (1/0)
Institution is in Rockies and plains region	Nominal	Region is a combination of Rockies and the plains (1/0)
Institution is in Mid East region (omitted category)	Nominal	Region is the Mid East (1/0)
Choice Goal		
Aspires to earn a PhD	Nominal	Highest academic degree planned is a PhD (1/0)

Aspires to earn a medical degree	Nominal	Highest academic degree planned is in medicine (1/0)
Aspires to earn a non-medical masters	Nominal	Highest academic degree planned is a masters in non-medicine field (1/0)

Analyses Set # 1

For the first set of research questions (student interest in STEM, STEM teaching, and secondary school teaching in recent data waves), I started with identifying the proportion of STEM students interested in pursuing secondary school teaching compared to other STEM majors in 2011 data wave. Next, with the first dependent variable (interest in STEM teaching compared to STEM majors), I ran descriptive statistics for each variable outlined in table 3. Specifically, I ran crosstabs, chi-square tests and ANOVA to determine the differences in independent variables of interest and interest in STEM teaching (compared to STEM majors). The results from the descriptive statistics are outlined in table 4. Following descriptive statistics, I ran binary logistic regression and examined the relationship between independent variables of interest and interest in STEM teaching (compared to STEM majors). The analytic sample for this analysis was 44,531 cases. The results from the analysis are outlined in table 5. Finally, I calculated predicted probabilities of choice of major/occupation measures to aid in the interpretation of results. I repeated the same procedure for the second dependent variable of interest second namely interest in STEM teaching compared with interest in secondary school teaching. The analytic sample for binary logistic regression analysis was 4,901 cases. The results from the analysis are outlined in table 6. I also calculated missing data in my analyses outlined in table 2(b). In the 2011 datawave analysis examining interest in STEM major versus STEM teaching, I had 44,531 cases in my analytic sample and the total number of STEM majors and STEM teachers in 2011 was 60,320. Therefore, I was missing roughly 26 percent of cases in this analysis that was obtained by dividing 44,531 by 60,320, and subtracting it from 100 percent. Similarly, in the 2011 datawave analysis examining interest in STEM teaching and secondary school teaching, I had 4,901 cases in my analytical sample and the total number of STEM teachers and secondary school teachers in 2011 was 7,202 cases, translating to 32 percent missing data.

The binary logistic regression coefficients (β_1, β_2,…, β_6, β_7) can be interpreted as the rate change in the log-odds per unit change in the independent variable (Allison, 2001; Allison, 2012; Hosmer, Lemeshow, & Sturdivant, 2013). One way of interpreting the logistic coefficients is through odd-ratios. Odds ratio can be interpreted as change in the odds of holding a particular category relative to the reference category that is associated with one-unit change in the specific independent variable (Allison, 2012; Hosmer, Lemeshow, & Sturdivant, 2013). An odds ratio of less than one reflects a decrease in the likelihood of event occurrence, an odds ratio of zero reflects no association, and an odds ratio of greater than one reflects an increase in the likelihood of event occurrence (Allison, 2012; Hosmer, Lemeshow, & Sturdivant, 2013).

I used statistical software (SPSS) to calculate binary logistic regression coefficients and their standard errors via the maximum likelihood estimation procedures. Each coefficient was evaluated using a Wald test. The Wald statistic in logistic regression is analogous to the t-test in the linear regression, and is primarily used to gauge the significance of coefficients. The Wald statistic is estimated by dividing the coefficient by the standard error to assess whether the coefficient is statistically significant (UCLA Logistic Regression, 2013). SPSS provides three other model fit statistics: McFadden pseudo-R^2, the ratio of scaled deviance (G^2) to its degrees of freedom and the model chi-square. I did not account for nesting of students within institutions in my analysis primarily because the students are beginning their studies at university and the impact of the institution on choice of major at the point of entry into the institution is minimal.

Analyses Set # 2

To address the second set of research questions (student interest in STEM, STEM teaching, and secondary school teaching over time) I started with identifying the proportion of STEM students interested in pursuing secondary school teaching compared to other STEM majors over time in each data wave (1976 and 2011). I also calculated the proportion of secondary school teachers that were majoring in STEM subjects. Next, with the first dependent variable as the outcome of interest (interest in STEM teaching compared to STEM majors), I ran descriptive statistics for each variable outlined in table 3, first for the full sample and then for each data wave. Specifically, I ran crosstabs, chi-square tests and ANOVA to determine the differences in independent variable of interests and interest in STEM teaching (compared to STEM majors). The results from the descriptive statistics are outlined in tables 7, 8, and 9. Following descriptive statistics, I ran binary logistic regression and examined the relationship between independent variables of interest and interest in STEM teaching (compared to STEM majors). The final model included all the variables outlined in table 3 as well as interactions with dummy variables for the 2011 data wave with 1976 dummy variable as the omitted category. The analytic sample for binary logistic regression analysis had 86,984 cases. Approximately, 30 percent of the cases were missing. The missing data percentage was calculated by dividing 86,984 by 124,574 and subtracting the resulting percentage from a 100 percent. The results from the analysis are outlined in table 8. Finally, I used the results and presented predicted probabilities of choice of major/occupation measures to aid in the interpretation of results.

In order to address the second set of research questions, I ran the same procedures as outlined above but with the second dependent variable as the outcome of interest i.e. interest in STEM teaching compared with interest in secondary school teaching. The results from the descriptive statistics are outlined in table 7. The analytic sample for binary logistic regression analysis had 11,314 cases. Approximately 32.5 percent of cases were missing. The missing data percentage was calculated by dividing 11,314 by 16,762 and subtracting the resulting percentage from a 100 percent. The results from the analysis are outlined in table 9. Finally, I used the results and presented predicted probabilities of choice of major/occupation measures to aid in the interpretation of results.

Analyses Set # 3

In order to address the third set of research questions (association between parental occupation and student interest over time and taking into account the gender of the parent and gender of the student, I first ran the zero order binary logistic model for each of the two dependent variables and parental occupation measures by gender. In other words, a zero order model included specific parental occupation measures as the only predictors in the model. I did so, so that I had baseline information about how much variation in student's choice of majors could be explained by the occupation of the parent for both male and female students. For instance, I selected sex=1 which is men in the sample; the outcome of interest was STEM teachers compared to STEM majors with two predictors namely father is in STEM occupation and mother is in STEM occupation. Then I ran a separate zero order model with two predictors namely father is a secondary school teacher and mother is a secondary school teacher. I repeated this step for women in the sample. I repeated this process for the second dependent variable (interest in STEM teaching versus secondary school teaching). Finally, I ran a set of binary logistic regression models. I ran the model separately for men and women in the sample for both outcomes of interest. The full model included dummy year variables and each of the variables outlined in table 3 as predictors. I used the results from these analyses and zero order model, and discuss them in detail in the findings section. The results are outlined in table 10. The reason I did not modify the model outlined in Analyses # 2 was because I was not simply interested in knowing whether parent-student relationship varied by gender but also how the parent-student relationship has varied over time taking into account both gender of the parent and gender of the student. In any event, I would not be able to run a three way interaction model because of quasi separation.

Limitations

This dissertation has three key limitations. First, this dissertation captures only about a third of STEM teacher supply because individuals can enter teaching at later stage of the teacher pipeline. They can do so through earning a graduate degree in education, passing state licensure exams, or through special programs such as Teach for America. In addition, preliminary analysis of BPS:09 suggests that approximately 30 percent of students that have an intention of majoring in STEM subject in their first year graduate with a STEM degree and approximately 40 percent of education majors graduate with a degree in education. Moreover, this dataset does not identify STEM education students i.e. education students with a concentration in STEM versus STEM students with an interest in teaching, the group I focus on in this dissertation. I am unable to distinguish between these two STEM teachers in this dissertation.

A second limitation is that the CIRP includes only proxies of the key construct self-efficacy (e.g., mathematical self-efficacy, written self-efficacy) and the measure may not fully capture the construct. However, the included measures are consistent with Bandura's (2006) recommendation for constructing questions to measure self-efficacy. Another related limitation is that it would be helpful to have better measures for other constructs as well. For instance, I do not have measures of STEM course taking in high school. Such measures would have been better measures of prior learning experiences. Another example is institutional variables. It would be very helpful to have measures such as whether an institution has a school of education, a school of engineering, or measures of school selectivity etc. This would have helped shed light on the type of institutions students are selecting based on early major/ career aspirations, providing better controls for the analyses.

A third limitation is that the data are cross-sectional. A panel dataset would be ideal as choice of major can and does change during undergraduate years (Malgwi, Howe, & Burnaby, 2005). For instance, incorporating variables that measure academic, social, extra-curricular experiences and institutional sources of support longitudinally can be critical in understanding student choice of major and career over time. Having a dataset that follows the same individual over time would enable an examination not only of major field selection, but also persistence in a major. Some longitudinal datasets (e.g., NCES Beginning Postsecondary Study, HERI datasets) do follow students over time though there may be some limitations. For instance, although HERI datasets capture similar measures post first year in college, the longitudinal samples are smaller, have less statistical power, and may significantly limit the analyses compared to the dataset used for this study (Sax, Jacobs, & Riggers, 2010).

CHAPTER 4: FINDINGS

The findings section is divided into three subsections. The first subsection is related to examination of differences among STEM teachers and STEM majors, and STEM teachers and secondary school teachers for the recent data waves (2011). The next subsection examines the historical interest (1976 and 2011) in being a STEM teacher or a STEM major, and a STEM teacher or a secondary school teacher. Finally, the last subsection examines relationship between parental occupation and student's choice overtime, taking into account both the gender of the parent as well as gender of the student.

Interest in STEM teaching compared to those with an interest in majoring in STEM subjects or Secondary school teaching for 2011 data waves

In response to research question 1 regarding descriptive statistics, I found that a very small proportion of STEM majors (approximately 1.7 percent) plan careers in education. This observation differs by gender. Approximately 1 percent of men and 2 percent of women majoring in STEM subjects express a desire to pursue STEM teaching. A higher proportion of secondary school teachers were STEM majors (approximately 8 percent). This also does differ by gender. Approximately 7 percent of men and 9 percent of women interested in secondary school teaching were majoring in STEM subjects. I acknowledge that differences by gender are relatively small. In the interest of being succinct, in the following discussion, I focus on those independent variables in detail where the difference between the groups is striking.

Characteristics of Students

In response to research question 2, I found the following.

Person inputs. Table 4 shows that women represent higher shares of secondary school teachers (62.5 percent) and STEM teachers (60.2 percent) than of STEM majors (42.4 percent). Whites tend to be highly represented in each category (as would be expected given that Whites are majority of population) i.e. secondary school teachers (76.2 percent), STEM teachers (72.7 percent), and STEM majors (60.6 percent) compared to students from minority groups though important differences remain within the categories and across minority groups. A slightly higher proportion of Asian and Black students major in STEM fields in comparison to teaching careers as STEM teachers or secondary school teachers. For instance, Asian students constitute a higher proportion of STEM majors (13.4 percent) compared to their representation among STEM teachers (5.3 percent) or secondary school teachers (3.3 percent). Blacks represent 7.1 percent STEM majors but only 3.8 percent of STEM teachers.

Background contextual affordances. Table 4 shows that a higher proportion of STEM majors (63.1 percent) had fathers with a college degree or more compared to STEM teachers (56.1 percent) and secondary school teachers (51.9 percent). STEM majors also had a higher proportion of fathers employed in STEM fields (25.3 percent) compared to STEM teachers (17.0 percent) and secondary school teachers (14.0 percent). STEM majors had the lowest proportion of fathers employed as secondary school teachers (1.8 percent) compared to STEM teachers (4.8 percent) and secondary school teachers (4.6 percent). In other words, STEM majors came from better educated families, from families with higher proportion of fathers employed in STEM fields and a lower proportion in secondary school teaching fields.

Learning experiences and self-efficacy. Table 4 shows a higher proportion of STEM teachers and STEM majors rated their mathematical self-efficacy as above average (76.6 percent and 69.5 percent respectively) compared to secondary school teachers (33.7 percent).

Interests and goals. Table 4 shows that a higher proportion of STEM majors (49.2 percent) expressed that it was important for them to strive for higher status in society compared to secondary school teachers (30.8 percent) and STEM teachers (27.6 percent). A higher proportion of STEM majors (77.7 percent) expressed that it was important for them to be financially well-off compared to secondary school teachers (64.1 percent) or STEM teachers (61.4 percent). A higher proportion of STEM majors also shared that it was important for them to make theoretical contributions to science (46.5 percent) compared to STEM teachers (29.2 percent) or secondary school teachers (7.7 percent).

With regards to degree aspirations, Table 4 shows that a higher proportion of STEM majors express a desire to pursue a medical degree (22.0 percent) compared to STEM teachers (2.5 percent) or secondary school teachers (0.6 percent). In contrast, a higher proportion of secondary school teachers as well as STEM teachers express a desire to pursue a non-medical master's degree (60.4 percent and 59.9 percent respectively) than STEM majors (35.7 percent).

Full Main Effects Model: STEM teaching compared to STEM major

The Nagelkerke R-square statistic suggests that the full main effects model explained 15.5 percent of the variation between interest in STEM teaching compared to interest in STEM majors. Logistic regression results are detailed in Table 5. In response to research questions 3 (a) – 3(c), I found that overall the analysis suggests that compared to STEM majors, STEM teachers are more likely to be women (odds-ratio = 2.432), from lower income background (odds-ratio = 0.905), with similar levels of prior academic achievement (e.g., non-statistically significant differences in high school GPA), but distinctively different interests and goals as well as degree aspirations. While all results from the logistic regression results are outlined in Table 5, in the discussion here I focus in greater depth on student's interests and goals as well as their degree aspirations.

In response to research question 3(d), I found that student interests and goals were an important predictor of students' interest in becoming STEM teachers compared to STEM majors. The desire to raise a family (odds-ratio = 1.563) was positively associated with an interest in STEM teaching rather than STEM major. The desire for higher status in society (odds-ratio = 0.645) and making a theoretical contribution to science (odds-ratio = 0.659) were negatively associated with the desire to pursue STEM teaching rather than STEM major.

Finally, in response to research question 3(e), I found that degree aspirations differed between the STEM teachers and STEM majors. The desire to pursue a medical degree (odds-ratio = 0.137) was negatively associated with desire to be a STEM teacher rather than STEM major. By contrast, the desire to pursue a non-medical masters (odds-ratio = 1.648) was positively associated with the desire to be a STEM teacher. The desire to pursue a doctoral degree was found to be statistically non-significant.

Full Main Effects Model: STEM teaching compared to secondary school teaching

The Nagelkerke R-square statistic suggests that the full main effects model explained 30.8 percent of the variation between interest in STEM teaching compared to interest in secondary school teaching. Logistic regression results are detailed in Table 6. In response to research questions 3 (a) – 3(c), I found that STEM teachers are more likely to be women (odds-ratio = 1.314) and tend to have higher high school GPA (odds-ratio = 1.144) compared to their secondary school teaching peers. The more striking differences between STEM teachers and secondary school teachers, however, are along the lines of interests and goals as well as degree aspirations.

In response to research question 3(d), I found that student interests and goals were important predictors of students' interest in becoming STEM teachers compared to secondary school teachers. The desire to make a theoretical contribution to science (odds-ratio = 3.536) was positively associated with an interest in STEM teaching. The desire to help others and influence social change (odds-ratio = 0.660) and the desire to be an artist (odds-ratio = 0.672) were negatively and statistically significantly associated with the desire to pursue STEM teaching rather than secondary school teaching.

Finally, in response to research question 3(e), I found that degree aspirations differed between the STEM teachers and secondary school teachers. The desire to pursue a medical degree was positively associated with desire to be a STEM teacher (odds-ratio

= 2.811) although statistical significance only at p<0.05 level. The desire to pursue a doctoral degree or a non-medical masters was not statistically significantly associated with the desire to be a STEM teacher compared to desire to be a secondary school teacher.

Full Model: Main Effects with Gender Interactions - STEM teaching compared to STEM major

In response to research question 3, Appendix A Table 11 shows the statistically significant interactions between gender and several independent variables. Two interactions of particular interest are, the interest and goals to make a theoretical contribution to science, and degree aspirations to earn a PhD. The interpretation of interaction in logistic regression is difficult. To facilitate interpretation of the gender differences, I conduct and report results of separate models for men and women. Table 5 shows the logistic regression odd-ratios for separate models for men and women. The analyses show that interest in making a theoretical contributions to science had a smaller negative effect on interest in STEM teaching than STEM major for men (odds-ratio=0.827) than for women (odds-ratio=0.565). The analyses show that the degree aspiration to earn a PhD was positively related to intent in STEM teaching rather than STEM major for men (odds-ratio=1.762) but negatively for women (odds-ratio=0.658).

Full Model: Main Effects with Gender Interactions - STEM teaching compared to secondary school teaching

In response to research question 3, Appendix A Table 12 shows the statistically significant interactions between gender and independent variables. However, none of the key variables were statistically significant interactions with gender. Table 6 shows the logistic regression odd-ratios for separate models for men and women.

Historical Interest in STEM teaching compared to those with an interest in majoring in STEM subjects or Secondary school teaching for 1976 and 2011 data waves

In response to research question 4 regarding descriptive statistics, I found that a very small proportion of STEM majors (under 2 percent) have historically planned careers in education. In 1976, approximately 1.3 percent of STEM majors identified as STEM teachers compared to approximately 1 percent in 2011. In addition, a small proportion of secondary school teachers identified as STEM majors (under 10 percent) over time. In 1976, 8.1 percent of secondary school teachers identified as STEM majors compared to 8.6 percent in 2011. The most striking differences between 1976 and 2011 are in the variables related to the background contextual affordances and interests, goals, and degree aspirations. In the interest of being succinct, in the discussion starting with Background Contextual Affordances, I focus on only those independent variables.

But before examining the factors associated with selection into the STEM teacher group, I want to present general trends as they relate to majoring in STEM subjects, majoring in secondary education, and majoring in STEM teaching. Preliminary descriptive analysis I conducted showed that the proportion of college going students majoring in STEM declined from between 1976 (19.6 percent) to 2006 (17.7 percent) but then rose by 2011 (22.5 percent) – refer to Appendix C Table 15 and Figure 3 for details. All things being equal, this trend could have generated a modest increase in the number of STEM teachers in the pipeline. However, preliminary descriptive results show that the fraction of STEM majors who are interested in teaching is very low, and has declined somewhat; even when some scholars (e.g., Jacobs, 2015) have suggested that there has been a the post-recession surge of interest in STEM fields. The proportion of college going students that majored in STEM subjects and wanted to pursue secondary school teaching remained steady between 1976 and 2006 (0.3 percent) but declined in 2011 (0.2). Thus, while there is great interest in increasing the number of STEM majors, we must acknowledge that very few who plan to enter this area of study do so with the intention of becoming a teacher.

Interest in secondary education as a major and teaching as a career has declined over the last several decades. The proportion of college students majoring in secondary education went up between 1976 (3.1 percent) and 2006 (3.7 percent) but then declined by 2011 (2.7 percent).[6]

When examining STEM teacher trends, I found the following. Among teachers, the proportion of STEM majors rose marginally from 1976 (8.2 percent) to 2011 (8.6 percent). Among STEM majors, the proportion that want to be STEM teachers declined slightly from 1976 levels (1.3 percent) to 2011 (1.0 percent). Although the shifts over time are small in magnitude, in 2011 there is greater interest in STEM majors, less interest in secondary school teaching, and less interest in STEM teaching compared to 1976. These trends have important consequences for STEM teacher supply, and policy

[6] I do not report trends in planning a career in education separately because there is substantial overlap between majoring in secondary education and planning a career in education (approximately 98 percent of secondary education students plan careers in education).

response to increase the number of STEM teachers.

Person inputs. Descriptive statistics from 1976 and 2011 data in table 7 shows that among women interest in STEM teaching (49.0 percent versus 60.2 percent) and majoring in STEM fields (28.1 percent versus 42.4 percent) has increased and the interest in secondary school teaching has slightly declined (63.7 percent versus 62.5 percent). The representation of minority groups interested in STEM majors increased over time. Asians represented 3.0 percent of STEM majors in 1976 versus 13.4 percent in 2011. Latinos represented 1.3 percent of STEM majors in 1976 versus 7.4 percent in 2011. Blacks represented 5.4 percent of STEM majors in 1976 versus 7.1 percent in 2011. There has also been an increase in representation of minorities among those interested in STEM teaching – Asians (0.6 percent in 1976 versus 5.3 percent in 2011), and Latinos (0.7 versus 7.6 percent). Similarly there has been an increase in representation of minorities among those interested in secondary school teaching – Asians (0.5 percent versus 3.3 percent), and Latinos (1.5 percent versus 6.2 percent). However while representations of Blacks increased among those interested in STEM majors, there has also been a decline in interest in STEM teaching and secondary school teaching – Blacks and STEM teaching (5.8 percent versus 3.8 percent) and secondary school teaching (7.7 percent versus 5.1 percent). Some may argue that this increase in interest is simply a reflection of the increase of minorities as a proportion of the US population, and that largely holds, but with some complications – see Appendix D Table 16 for details. Census data shows that Asians constituted 0.8 percent of the US population in 1970 and 4.9 percent in 2010. However, the proportion of Asian students in the HERI sample suggests that they were better represented among first year college students compared to their representation in the US population – 1.8 percent of first year college students in 1976 and 9.4 percent in 2011. Proportion of Latinos among first year students is marginally higher than what the census data suggests. For instance, in 1970 Latinos constituted 4.4 percent of the US population compared to 16.3 percent in 2010, roughly four times the figure in 1970. The HERI data shows that Latinos represented 1.6 percent of first year students in the sample and 7.7 percent in 2011, which is a little over four times the 1976 figure. Finally, 1970 census data suggests that Blacks constituted 11.1 percent and 12.6 percent of the US population in 1970 and 2010 respectively. HERI data shows that their representation among first year students dropped marginally from 9.5 percent of first year college students in 1976 to 8.5 percent in 2011.

Background contextual affordances. In response to research question 5, overall, in 2011, I found that STEM majors come from more elite families especially in terms of better educated fathers compared to STEM teachers and secondary school teachers. Also, in 2011 all students come from better income families compared to 1976. Table 7 shows that in 2011 a higher proportion of STEM majors have fathers with a college degree or more (63.1%) compared to STEM teachers (56.1%) and secondary school teachers (51.9%). The percentage with fathers with a college degree or more has gone up dramatically among STEM majors (47.7 percent of students in 1976 to 63.1 percent of students in 2011), STEM teachers (38.1 percent to 56.1 percent), and secondary school teachers (32.7 percent versus 51.9 percent). The percentage of students coming from families with median incomes of 50,000 or more increased among STEM majors (76.5 percent of students in 1976 to 85.6 percent of students in 2011) and secondary school teachers (77.9 percent to 82.9 percent) but not among STEM teachers (83.5 percent to 85.3 percent).

Interests and goals. When examining interests and goals in 1976 and 2011 for STEM majors, STEM teachers, and secondary school teachers, I found that across all three groups there has been a steep increase in the desire to be financially well off and the desire to raise a family, a somewhat moderate increase in desire to make a theoretical contribution to science, and a steep decline in the desire to develop a meaningful philosophy of life.

Table 7 shows that proportion of STEM majors with the desire to be financially well-off rose sharply (51.5 percent in 1976 to 77.7 percent in 2011); desire to raise a family went up (53.1 percent in 1976 to 71.3 percent in 2011); making a theoretical contribution went up moderately (36.8 percent in 1976 to 46.5 percent in 2011); and a steep decline in the desire to develop a meaningful philosophy of life (64.4 percent to 46.7 percent).

Table 7 shows that proportion of STEM teachers with the desire to be financially well-off rose sharply (32.8 percent in 1976 to 61.4 percent in 2011); desire to raise a family went up (58.4 percent in 1976 to 79.6 percent in 2011); making a theoretical contribution went up moderately (21.5 percent in 1976 to 29.2 percent in 2011); and a steep decline in the desire to develop a meaningful philosophy of life (65.5 percent to 43.1 percent).

Table 7 shows that proportion of secondary school teachers with the desire to be financially well-off rose sharply (36.9 percent in 1976 to 64.1 percent in 2011); desire to raise a family went up (60.8 percent in 1976 to 80.7 percent in 2011); and a steep decline in the desire to develop a meaningful philosophy of life (65.8 percent to 48.9 percent).

Degree aspirations. Over time, the proportion reporting aspiring to a PhD increased among all 3 groups rising from 19.5 percent to 27.1 percent among STEM majors, 12.9 percent to 22.1 percent among STEM teachers, and 11.6 to 19.9 percent among secondary school teachers. Interest in pursuing a non-medical master's degree increased for all three groups but especially among those aspiring to secondary school teching rising from 32.1 percent to 35.7 percent to STEM majors, 53.7 percent to 59 percent for STEM teachers, and 50.8 percent and 60.4 percent for secondary school teachers.

Full Main Effects Model: STEM teaching compared to STEM major over time (1976 and 2011)

The Nagelkerke R-square statistic shows that the full main effects model explained 13.6 percent of the variation between interest in STEM teaching compared to interest in STEM majors. The model whose results I report here included both cohorts of students in 1976 and in 2011 in one model with a YEAR as a predictor to indicate if there have been changes in interest in STEM major and STEM teaching over time. However, I also ran two separate models one with data only from the 1976 cohort and another with data only from the 2011 cohort as this would help in interpreting interactions from the main model. Logistic regression analyses results from all three models are outlined in Table 8. In response to research question 6 (a) to 6 (c), I found that interest in STEM teaching among STEM majors in unchanged between 1976 and 2011. I also found that women (odds-ratio=2.413) are more likely than men to be STEM teacher than STEM major. Asians (odds-ratio=0.362), Blacks (odds-ratio=0.477), and Latinos (odds-ratio=0.598) are less likely than Whites to be STEM teachers than STEM major. Those with higher level of father's education (odds-ratio=0.925), parental income (odds-ratio=0.891), and high school GPA (odds-ratio = 0.935) are also less likely to be interested in STEM teaching than majoring in STEM subject. Interests, goals, and degree aspirations continue to be very important predictors of interest in STEM teaching. The desire to raise a family (odds-ratio = 1.279) and the desire to help others and influencing social change (odds-ratio = 1.153) were positively associated with an interest in STEM teaching. The desire to strive for status in society (odds-ratio = 0.695) and making a theoretical contribution to science (odds-ratio = 0.675) were negatively associated with the desire to pursue STEM teaching. The desire to develop a meaningful philosophy of life was statistically non-significant after controlling for other variables.

Finally, in response to research question 6(e), I found that degree aspirations differed between the STEM teachers and STEM majors. The desire to pursue a medical degree versus not earning the medical degree (odds-ratio = 0.246) was negatively associated with desire to be a STEM teacher rather than STEM major. By contrast, the desire to pursue a non-medical masters (odds-ratio = 1.665) was positively associated with the desire to be a STEM teacher. The desire to pursue a doctoral degree was statistically non-significant after controlling for other variables.

Full Main Effects Model: STEM teaching compared to secondary school teaching over time (1976 and 2011)

The Nagelkerke R-square statistic suggests that the full main effects model explained 32.4 percent of the variation between interest in STEM teaching compared to interest in secondary school teaching. Logistic regression results are outlined in Table 9. There is less interest in STEM teaching than secondary school teaching in 2011 than in 1976 (odds-ratio=0.666). In response to research questions 6(a) to 6(c), I also found that STEM teachers and secondary school teachers have similar demographic and parental backgrounds but that STEM teachers have higher high school GPA (odds-ratio = 1.152) than secondary school teachers.

In response to research question 6(d), I found that student interest and goals were important predictors of students' interest in becoming STEM teachers compared to secondary school teachers. The desire to making a theoretical contribution to science (odds-ratio = 3.671) was positively and statistically significantly associated with an interest in STEM teaching rather than secondary school teaching. The desire to help others and influencing social change (odds-ratio = 0.738), the desire to be an artist (odds-ratio = 0.622), and the desire to strive for status in society (odds-ratio = 0.805) were negatively associated with the desire to pursue STEM teaching rather than secondary school teaching. The desire to develop a meaningful philosophy of life and the desire to raise a family were statistically non-significant after controlling for other variables.

Finally, in response to research question 6(e), I found that degree aspirations differed among the STEM teachers and secondary school teachers. The desire to pursue a medical degree (odds-ratio = 5.575) was positively and statistically significantly associated with desire to be a STEM teacher. The desire to pursue a non-medical master's degree and the desire to pursue a doctoral degree rather than not earning those degrees were non-statistically significant.

Full Main Effects Model with Year Interactions: STEM teaching compared to STEM majors over time (1976-2011)

The Nagelkerke R-square statistic in Appendix B Table 13 suggests that the full main effects model with year interactions explained 14.9 percent of the variation between interest in STEM teaching compared to interest in STEM majors. In response to research question 6, Appendix B Table 13 shows that the following interactions were found to be statistically significant. Two key interactions that were found to be statistically significant were raising a family and the year 2011 (odds ratio = 1.390) and the degree aspiration to earn a MD and the year 2011 (odds ratio = 0.418). In order to facilitate the interpretation of interactions, I ran separate models for cohort 1976 and the cohort 2011. I found interest in raising a family was a stronger predictor of STEM teaching than STEM major in 2011 (odds-ratio=1.563) than in 1976 (odds-ratio = 1.125). Desire to earn a medical degree was a more negative predictor of STEM teaching than STEM major in 2011 (odds-ratio = 0.137) than in 1976 (odds-ratio = 0.327).

Full Main Effects Model with Year Interactions: STEM teaching compared to secondary school teaching over time (1976 and 2011)

The Nagelkerke R-square statistic in Appendix B Table 14 suggests that the full main effects model explained 33.6 percent of the variation between interest in STEM teaching compared to interest in secondary school teaching. In response to research question 6, Appendix B Table 14 shows that two key interactions that were found to be statistically significant were sex and year (odds ratio = 1.809) and striving for higher status in society and year (odds ratio = 1.244). In order to facilitate the interpretation of interactions, I ran separate models for cohort 1976 and the cohort 2011. I found that in 1976 women were less likely than men to express a desire to pursue STEM teaching compared to secondary school teaching (odds-ratio = 0.726) whereas in 2011 they are more likely to do so (odds-ratio = 1.314). In 1976 those that valued striving for higher status in society were less likely to express an interest in STEM teaching compared to secondary school teaching (odds-ratio = 0.731) whereas in 2011 striving for status is not statistically significant.

Association of parental occupation on student's major intentions over time taking into account gender of parent and gender of student

Table 10 outlines results from the zero order models. Through the zero order models I wanted to observe how much do only parental occupation variables explain student choice between majoring in STEM, STEM teaching, and secondary school teaching. The zero order model included only the parental occupation variables. I ran a zero order model to examine the associations between parental occupation and student's choice without any other controls in the model.

When examining STEM students with parents with occupations in STEM fields, I found that having a father employed in STEM fields lowered the odds of both their sons and daughters interest in STEM teaching compared to majoring in STEM fields (odds for sons: 0.642, odds for daughter: 0.685). However, having a father with occupations in secondary school teaching had a positive association with interest in STEM teaching rather than STEM major for both sons and daughters (odds for sons: 2.798, odds for daughters: 1.487).

When examining students with interest in teaching (STEM teaching or secondary school teaching) and with parents with occupations in STEM fields, results showed that having a father employed in STEM fields increased the odds of both their sons and daughters interest in STEM teaching compared to majoring in STEM fields (odds for sons: 1.439, odds for daughter: 1.328). By contrast, having a mother employed in STEM fields had a positive association with STEM teaching but only for daughters (odds ratio: 1.227). In addition, having a father with occupations in secondary school teaching had a positive association with interest in STEM teaching rather than secondary school teaching for only sons (odds: 1.41).

In response to research question 7, Table 10 shows that parental occupation was not related to interest in STEM teaching rather than STEM major and secondary school teaching after controlling for other variables for any combination of parents occupation and students gender.

CHAPTER 5: DISCUSSION AND CONCLUSIONS

The main goal of this study was to identify a potential pool of STEM teachers as a way of addressing STEM teacher shortage in the US. I found several interesting findings. Descriptive statistics from recent datawave shows that women constitute a higher proportion of both STEM teachers as well as secondary school teachers compared to STEM majors. Whites constitute a higher proportion of secondary school teachers and STEM teachers compared to STEM majors. Minority students, by contrast, have a higher representation as STEM majors vis-à-vis their representation among STEM teachers and secondary school teachers (see next para for trends separated by race/ethnicity). Compared with STEM teachers and secondary school teachers, STEM majors have better educated fathers, have higher proportion of fathers in STEM occupations, and a lower proportion of fathers in secondary school teaching occupations. STEM teachers have similar levels of high school GPA compared to their STEM major peers and higher compared to their secondary school teaching peers. STEM teachers have higher self-rated mathematical ability compared to both STEM majors and secondary school teachers. In terms of interests and goals, a higher proportion of STEM majors than STEM teachers and secondary school teachers had interest in being financially well-off and striving for higher status in society, making a theoretical contribution to science, and pursuing a medical degree.

Descriptive statistics show that among women interest in STEM teaching and majoring in STEM fields increased between 1976 and 2011, while interest in secondary school teaching slightly declined. Among Asians and Latinos there has also been an increase in STEM teaching and secondary school teaching. However among Blacks, while there has been an increase in interest in STEM majors, there has been a decline in interest in STEM teaching and secondary school teaching. I acknowledge that this is complicated by the increase in minority populations within the larger U.S. population. STEM majors continue coming from better educated and higher income families. With regards to interests, across all three groups (STEM majors, STEM teachers, and secondary school teachers) there has been a steep increase in the desire to be financially well-off and raise a family, a moderate increase in desire to make a theoretical contribution to science, and a steep decline in desire to develop a meaningful philosophy of life. Finally, descriptive statistics show that the desire to earn a doctoral degree has increased especially among STEM majors and STEM teachers whereas the desire to earn non-medical masters degrees increased among secondary school teachers.

Logistic regression analyses from recent data wave (2011) suggest that interest in STEM teaching compared to majoring in STEM fields does differ by several independent variables. Women are more likely than men to be STEM teachers than STEM majors after controlling for other variables. This finding is consistent with previous research that suggests that teaching is a feminized profession and that whites are more likely than individuals from minority groups to pursue teaching careers (Guarino, Santibanez, & Daley, 2006). Both Asian and Black students are less likely than Whites to be interested in STEM teaching compared to being STEM majors. When examining interest in STEM teaching rather than secondary school teaching, race was a statistically non-significant predictor.

Logistic regression analyses also showed that students from higher income families are less likely than students from lower income families to be interested in STEM teaching compared to STEM majors. This finding is consistent with previous literature that shows that those from lower income backgrounds are likely to be interested in teaching careers whereas those from higher income backgrounds are likely to pursue STEM majors (Davies & Guppy, 1997; Trusty, Robinson, Plata, & Ng, 2000). In addition, having a father employed in STEM fields lowers the odds of the student's interest in STEM teaching compared to STEM majors whereas having a father in the secondary education field increases the odds of interest in STEM teaching compared to STEM majors. Logistic regression analyses from recent data wave (2011) shows that STEM teachers compared to their secondary school teaching peers come with similar parental income, and parental occupation. Those interested in STEM teaching rather than secondary school teaching are more likely to be women and have better educated fathers.

In terms of learning experiences and self-efficacy, STEM teachers tend not to differ in terms of prior academic achievement as measured by high school grade point averages, compared to STEM majors but have higher high school grade point averages compared to secondary school teachers. STEM teachers also have higher self-rated mathematical ability compared to both STEM majors and secondary school teachers. Previous research shows that students who are interested in STEM majors tend to have higher grade point averages than students interested in education majors (Sax, Jacobs, & Riggers, 2010).

STEM teachers differ from their STEM major peers in terms of interests and goals. Desire to pursue STEM teaching rather than being a STEM major is positively associated with an interest in raising a family. STEM teachers are less interested in making money and striving for status in society compared to STEM majors. This finding is consistent with prior research on the teacher pipeline that shows that education majors placed greater emphasis on raising a family whereas STEM majors placed greater emphasis on salary, prestige, and advancement opportunities (Guarino, Santibanez, & Daley, 2006). The desire to make a theoretical contribution to science and the desire to be a scholar were negatively associated with the desire to pursue STEM teaching compared to STEM majors.

Student interests and goals also differentiated between STEM teachers and secondary school teachers. The desire to make a theoretical contribution to science was associated with an interest in STEM teaching rather than secondary school teachers. The desire to help others and influencing social change and desire to be an artist were negatively associated with the desire to pursue STEM teaching. The degree aspirations differed between STEM teachers and secondary school teachers. The desire to pursue a medical degree was positively associated with an interest in STEM teaching rather than secondary school teaching. Neither the desire to pursue a doctoral degree nor the desire to earn a non-medical master's degree were statistically significant.

Implications for Policy and Practice

The results of this dissertation have important implications for policy and practice especially as they relate to study's key goal, increasing STEM teachers. The most direct implications of this study will be for academic advisors both at the high school as well as at universities. Brown and Lent (1996) also highlighted that several core SCCT variables (e.g. self-efficacy, outcome expectations, interests, goals) are malleable and can change with proper guidance and support by advisors. Brown and Lent (1996) assert that sometimes students need guidance and encouragement so that they do not eliminate certain majors pre-maturely. There may be STEM students who do not consider teaching as a possible career and advisors can play a key role here.

Results from this dissertation also show that some STEM students with high high school GPAs and high self-rated mathematical ability choose STEM teaching. Academic advisors can guide these students towards experiences that can affirm their interest in STEM teaching (e.g., gaining teaching experience in a school that they would like to teach at in the future).

Academic advisors can play a key role in aligning academic plans and career plans. Student interests were associated with different choices, and academic advisors guide students' understandings. For instance, a high achieving female student wants to go into STEM teaching rather than a medical degree or a doctoral degree because raising a family is important to her. An academic advisor can discuss more deeply how to enter STEM teaching or help brainstorm ways in which she can pursue a medical degree but yet find ways to raise a family. This guidance can be helpful for recruiting STEM teachers in the long term because research already shows that STEM teacher turnover is a major problem (e.g., Ingersoll, 2001, 2007, 2010). I hope that the findings from this dissertation will be helpful for informing academic advising and other institutional interventions that may improve the pipeline of STEM secondary school educators.

This dissertation also shows that students share that financial security is increasingly important to them. Students aspiring to be teachers saw teaching as compatible with raising a family, more so in 2011, than in 1976. Policy makers should closely examine these trends to identify ways in which to make teaching a more attractive profession in the long term – both in terms of financial incentives as well as working conditions.

Implications for Research

This dissertation suggests several areas for future research. First, having a comprehensive longitudinal dataset that captures different paths into STEM teaching beginning in high school would be ideal. Such data can enable researchers to examine the origins, motivations, and career trajectories for different pools of STEM teachers over a lifetime. For instance, when examining career intentions for beginning first year students, following first year students longitudinally and understanding how their decision making shifts during their undergraduate years can improve understanding of how their decision making evolves especially as it relates to academic variables, demographic variables, student values, degree aspirations, and institutional variables. Having a dataset that follows the same individual over time would enable an examination not only of major field selection, but also persistence in a major and career intention especially as related to STEM teaching.

Second, researchers can examine questions analyzed in this study but with different and perhaps more comprehensive measures. It would be helpful to have a broader array of pre-college academic measures than were available in this dataset.

Particularly useful would be measures of honors or AP courses taken, STEM courses taken, participation in afterschool or summer enrichment programs, and internships pursued. It would also be helpful to have a more comprehensive array of institutional measures. Future research should also consider how major and career plans and outcomes are influenced by students' decision to attend a higher education institution that has a school of education with strong reputation to produce teachers, or the decision to attend an institution with a school of science and engineering that has a strong track record of producing scientists and placing students in doctoral programs or medical programs.

Third, a more qualitative analysis can provide the context for findings in this study. A qualitative line of research might probe students interests and goals more completely, and explore how those interests and goals are shaped by various experiences not measured in this study (e.g., courses taken, perceptions of classroom climate).

Fourth, a historical examination can also expand our understanding and provide the larger narrative of how the interest in secondary school teaching has evolved over time and how it juxtaposes with interest in evolution of STEM teaching. This historical examination of interest in STEM teaching reveals that compared to STEM major peers, overall interest in STEM teaching has not changed over time. By contrast, there has been a decline in interest in STEM teaching among students interested in secondary school teaching. A study that examines how a student interested in majoring in STEM decides that it is the right fit for them, understanding the types of hurdles the student faces, and the resources available to the student that enable him/her to align his/her academic plans, interests, and career goals would be helpful.

Finally, it is important conduct research that compares how interest in STEM teaching has changed in 2011 compared to 2006 (i.e., before and after the great recession of 2008). It is possible that families that were hard hit by the financial crisis were no longer able to afford sending their son or daughter to a four year college or university. Those students may have chosen to go to community colleges instead and the dataset used in my study does not capture these changes. As such, the profile of students who attended four-year colleges in 2006 may be different from the student that attended college in 2011.

Table 4: Descriptive Results – Interest in STEM teaching compared to those with an interest in majoring in STEM subjects for 2011 data – proportion that identify with a specific independent variable

	STEM TEACHERS (N=609)	STEM Majors (N=59,711)	SECONDARY SCHOOL TEACHERS (N=6,493)
Sex: Female	60.2%	42.4%	62.5%
Race: Identifies as Asian	5.3%	13.4%	3.3%
Race: Identifies as Black	3.8%	7.1%	5.1%
Race: Identifies as Latino	7.6%	7.4%	6.2%
Race: Identifies as Other	10.6%	11.5%	9.3%
Race: White	72.7%	60.6%	76.2%
Father's education: earned a Bachelor's degree or higher	56.1%	63.1%	51.9%
Mother's education: earned a Bachelor's degree or higher	61.9%	64.3%	55.4%
Parental Income Quintile: household income >= $50K/year	85.3%	85.6%	82.9%
Father's occupation is STEM	17.0%	25.3%	14.0%
Mother's occupation is STEM	14.7%	19.3%	13.4%
Father's occupation is secondary school teaching	4.8%	1.8%	4.6%
Mother's occupation is secondary school teaching	6.7%	4.4%	7.1%
High school grade point average	94.0%	95.4%	90.1%
Self-rated mathematical ability	76.6%	69.5%	33.7%
Expects to be a leader	48.2%	49.2%	47.3%
Expects to make at least a 'B'	69.5%	71.9%	69.1%
Interests and goals: Be financially well-off	61.4%	77.7%	64.1%

Interests and goals: Developing meaningful philosophy of life	43.1%	46.7%	48.9%
Interests and goals: Helping others in difficulty	71.3%	67.7%	76.3%
Interests and goals: Make a theoretical contribution to science	29.2%	46.5%	7.7%
Interests and goals: Raising a family	79.6%	71.3%	80.7%
Interests and goals: scholar	57.6%	63.5%	49.9%
Interests and goals: social activism and helping others in difficulty	42.6%	42.5%	46.1%
Interests and goals: interested in artistic endeavors	34.9%	34.7%	46.3%
Interests and goals: striving for higher social status	27.6%	49.2%	30.8%
Interests and goals: Intrinsic reasons for pursuing education	71.0%	69.0%	70.8%
Interests and goals: Extrinsic reasons for pursuing education	49.5%	65.4%	53.5%
Degree aspirations: Aspires to earn a PhD	22.1%	27.1%	19.9%
Degree aspirations: Aspires to earn a medical degree	2.5%	22.0%	0.6%
Degree aspirations: Aspires to earn a non-medical masters	59.9%	35.7%	60.4%
Undergraduate enrollment	33.9%	48.1%	29.1%
Student to faculty ratio	9.4%	9.7%	10.7%
Type of educational institution (University)	37.0%	58.0%	29.6%
Type of religious institution	42.7%	26.6%	46.5%
Attends Historically Black College	1.2%	2.7%	2.0%
Attends a public or private institution	46.0%	2.4%	42.8%

Institution is in New England region	16.3%	11.3%	13.8%
Institution is in Middle East region	18.6%	18.3%	19.1%
Institution is in Great Lakes region	16.1%	15.4%	20.9%
Institution is in South East region	21.3%	25.4%	21.2%
Institution is in South West region	3.0%	3.6%	4.6%
Institution is in Far West region	17.2%	18.0%	11.4%
Institution is in Rockies and plains region	7.6%	7.9%	9.1%

Table 5: Logistic Regression Results – Interest in STEM teaching compared to those with an interest in majoring in STEM subjects for 2011 data – Main Effects Model [N=44,531]

	Exp (B) (p-value)		
		Women	**Men**
Sex: Female	2.432 (0.000)		
Race: Identifies as Asian	0.480 (0.002)	0.532 (0.030)	0.374 (0.015)
Race: Identifies as Black	0.553 (0.055)	0.581 (0.180)	0.510 (0.164)
Race: Identifies as Latino	0.751 (0.205)	0.779 (0.392)	0.726 (0.369)
Race: Identifies as Other	0.901 (0.523)	0.943 (0.776)	0.812 (0.436)
Father's education: earned a Bachelor’s degree or higher	0.970 (0.311)	0.980 (0.600)	0.954 (0.314)
Parental Income Quintile: household income >= $50K/year	0.905 (0.020)	0.920 (0.130)	0.870(0.042)
Father's occupation is STEM	0.745 (0.035)	0.654 (0.023)	0.884 (0.561)
Mother's occupation is STEM	0.922 (0.566)	0.914 (0.630)	0.939 (0.770)
Father's occupation is secondary school teaching	2.130 (0.002)	2.306 (0.008)	2.010 (0.059)
Mother's occupation is secondary school teaching	1.248 (0.273)	1.302 (0.320)	1.199 (0.563)
High school grade point average	0.937 (0.174)	1.022 (0.753)	0.858 (0.021)
Self-rated mathematical ability	1.472 (0.000)	1.584 (0.000)	1.262 (0.028)
Expects to be a leader	1.300 (0.000)	1.364 (0.000)	1.236 (0.020)
Expects to make at least a 'B'	1.049 (0.635)	1.076 (0.582)	1.038 (0.812)
Interests and Goals: Developing meaningful philosophy of life	0.990 (0.856)	1.039 (0.601)	0.910 (0.295)
Interests and Goals: Make a theoretical contribution to science	0.659 (0.000)	0.565 (0.000)	0.827 (0.049)
Interests and Goals: Raising a family	1.563 (0.000)	1.537 (0.000)	1.611 (0.000)

Interests and Goals: Becoming a scholar	0.825 (0.004)	0.783 (0.006)	0.872 (0.190)
Interests and Goals: social activism and helping others in difficulty	1.093 (0.149)	1.107 (0.202)	1.077 (0.455)
Interests and Goals: Identifies as interested in artistic endeavors	1.104 (0.117)	1.046 (0.602)	1.199 (0.057)
Interests and Goals: Identifies as striving for higher social status	0.645 (0.000)	0.700 (0.000)	0.576 (0.000)
Interests and Goals: Intrinsic reasons for pursuing education	1.102 (0.104)	1.082 (0.338)	1.106 (0.257)
Interests and Goals: Extrinsic reasons for pursuing education	0.748 (0.000)	0.704 (0.000)	0.829 (0.048)
Degree Aspirations: Aspires to earn a PhD	1.010 (0.951)	0.658 (0.061)	1.762 (0.026)
Degree Aspirations: Aspires to earn a medical degree	0.137 (0.000)	0.113 (0.000)	0.175 (0.005)
Degree Aspirations: Aspires to earn a non-medical masters	1.648 (0.000)	1.456 (0.039)	1.890 (0.004)
Undergraduate enrollment	1.000 (0.006)	1.000 (0.012)	1.000 (0.287)
Student to faculty ratio	1.116 (0.000)	1.113 (0.000)	1.109 (0.000)
Type of educational institution	0.811 (0.259)	0.632 (0.056)	1.077 (0.805)
Type of religious institution	1.673 (0.020)	1.038 (0.894)	3.470 (0.001)
Attends Historically Black College	0.608 (0.385)	0.427 (0.284)	1.262 (0.782)
Attends a public or private institution	0.987 (0.952)	1.007 (0.979)	1.101 (0.780)
Institution is in New England region	1.359 (0.070)	1.441 (0.113)	1.169 (0.536)
Institution is in Great Lakes region	0.932 (0.680)	1.056 (0.817)	0.684 (0.134)
Institution is in Far West region	0.856 (0.410)	1.127 (0.624)	0.513 (0.032)
Institution is in South East region	0.783 (0.155)	1.035 (0.875)	0.425 (0.003)
Institution is in Rockies and plains region	1.017 (0.931)	1.020 (0.945)	0.887 (0.680)

Institution is in South West region	0.936 (0.821)	0.899 (0.792)	0.892 (0.791)

Goodness of fit Statistics: -2 Log likelihood = 4199.786, Cox & Snell R-square:0.016, Nagelkerke R-square = 0.155
Goodness of fit Statistics (for men): -2 Log likelihood = 1851.735, Cox & Snell R-square:0.009, Nagelkerke R-square = 0.120
Goodness of fit Statistics (for women): -2 Log likelihood = 2283.742, Cox & Snell R-square:0.026, Nagelkerke R-square = 0.189

Table 6: Logistic Regression Results – Interest in STEM teaching compared to those with an interest in secondary school teaching for 2011 data: Full model [N=4,901]

	Exp (B) (p-value)	Women	Men
Sex: Female	1.314 (0.028)		
Race: Identifies as Asian	0.909 (0.751)	1.298 (0.469)	0.504 (0.227)
Race: Identifies as Black	1.277 (0.504)	1.360 (0.525)	1.417 (0.551)
Race: Identifies as Latino	1.198 (0.523)	1.412 (0.341)	1.278 (0.596)
Race: Identifies as Other	1.371 (0.106)	1.462 (0.130)	1.338 (0.374)
Father's education: earned a Bachelor's degree or higher	1.097 (0.008)	1.120 (0.014)	1.082 (0.152)
Parental Income Quintile: household income >= $50K/year	1.030 (0.565)	1.052 (0.447)	0.991 (0.916)
Father's occupation is STEM	0.926 (0.644)	0.804 (0.309)	1.154 (0.592)
Mother's occupation is STEM	0.957 (0.793)	1.106 (0.648)	0.820 (0.452)
Father's occupation is secondary school teaching	0.991 (0.975)	1.441 (0.295)	0.622 (0.286)
Mother's occupation is secondary school teaching	0.754 (0.219)	0.624 (0.113)	0.934 (0.854)
High school grade point average	1.144 (0.013)	1.257 (0.004)	1.052 (0.510)
Self-rated mathematical ability	2.583 (0.000)	2.804 (0.000)	2.377 (0.000)
Expects to be a leader	0.974 (0.708)	0.980 (0.832)	0.916 (0.430)
Expects to make at least a 'B'	0.999 (0.994)	0.958 (0.773)	1.052 (0.789)
Interests and goals: Developing meaningful philosophy of life	0.970 (0.651)	1.028 (0.747)	0.868 (0.199)
Interests and goals : Make a theoretical contribution to science	3.536 (0.000)	3.806 (0.000)	3.558 (0.000)

Interests and goals : Raising a family	1.096 (0.199)	1.076 (0.429)	1.181 (0.154)
Interests and goals: Becoming a scholar	0.904 (0.185)	0.855 (0.120)	0.989 (0.930)
Interests and goals: social activism and helping others in difficulty	0.660 (0.000)	0.693 (0.000)	0.628 (0.000)
Interests and goals: artistic endeavors	0.672 (0.000)	0.662 (0.000)	0.678 (0.000)
Interests and goals: striving for higher social status	0.909 (0.222)	0.859 (0.132)	0.967 (0.792)
Interests and goals: Intrinsic reasons for pursuing education	1.046 (0.513)	1.059 (0.542)	0.991 (0.929)
Interests and goals: Extrinsic reasons for pursuing education	0.925 (0.260)	0.867 (0.114)	1.032 (0.783)
Degree Aspirations: Aspires to earn a PhD	0.982 (0.927)	0.861 (0.568)	1.214 (0.526)
Degree Aspirations: Aspires to earn a medical degree	2.811 (0.023)	3.431 (0.025)	2.007 (0.430)
Degree Aspirations: Aspires to earn a non-medical masters	0.958 (0.788)	0.987 (0.951)	0.915 (0.730)
Undergraduate enrollment	1.000 (0.704)	1.000 (0.820)	1.000 (0.345)
Student to faculty ratio	0.938 (0.004)	0.946 (0.051)	0.924 (0.038)
Type of educational institution	1.248 (0.291)	0.949 (0.846)	1.953 (0.056)
Type of religious institution	1.252 (0.373)	0.906 (0.757)	2.251 (0.063)
Attends Historically Black College	0.748 (0.649)	0.461 (0.376)	2.324 (0.397)
Attends a public or private institution	1.639 (0.052)	1.439 (0.266)	2.076 (0.086)
Institution is in New England region	1.611 (0.016)	1.483 (0.139)	1.671 (0.093)
Institution is in Great Lakes region	0.770 (0.184)	0.926 (0.771)	0.555 (0.048)
Institution is in Far West region	2.370 (0.000)	3.367 (0.000)	1.155 (0.726)
Institution is in South East region	1.229 (0.278)	1.726 (0.026)	0.605 (0.124)
Institution is in Rockies and plains region	1.041 (0.864)	1.023 (0.944)	0.992 (0.981)

Institution is in South West region	0.737 (0.374)	0.550 (0.204)	0.944 (0.911)

Goodness of fit Statistics: -2 Log likelihood = 2218.717, Cox & Snell R-square:0.140, Nagelkerke R-square = 0.308
Goodness of fit Statistics (for men): -2 Log likelihood = 855.734, Cox & Snell R-square:0.152, Nagelkerke R-square = 0.33
Goodness of fit Statistics (for women): -2 Log likelihood = 1318.242, Cox & Snell R-square:0.145, Nagelkerke R-square = 0.323

Table 7 (a): Descriptive Results – STEM majors and STEM teachers for 1976 and 2011, overall descriptive data – proportion that identify with a specific independent variable

	STEM MAJORS		STEM TEACHERS	
	1976 (N=63,433)	2011 (N=59,711)	1976 (N=821)	2011 (N=609)
Sex: Female	28.1%	42.4%	49.0%	60.2%
Race: Identifies as Asian	3.0%	13.4%	0.6%	5.3%
Race: Identifies as Black	5.4%	7.1%	5.8%	3.8%
Race: Identifies as Latino	1.3%	7.4%	0.7%	7.6%
Race: Identifies as Other	3.0%	11.5%	2.3%	10.6%
Race: White	87.3%	60.6%	90.6%	72.7%
Father's education: earned a Bachelor's degree or higher	47.7%	63.1%	38.1%	56.1%
Mother's education: earned a Bachelor's degree or higher	30.6%	64.3%	23.5%	61.9%
Parental Income Quintile: household income >= $50K/year	76.5%	85.6%	83.5%	85.3%
Father's occupation is STEM	22.9%	25.3%	12.9%	17.0%
Mother's occupation is STEM	9.3%	19.3%	7.9%	14.7%
Father's occupation is secondary school teaching	3.2%	1.8%	7.8%	4.8%
Mother's occupation is secondary school teaching	3.6%	4.4%	3.6%	6.7%
High school grade point average	85.4%	95.4%	86.7%	94.0%
Self-rated mathematical ability	69.5%	69.5%	72.7%	76.6%
Expects to be a leader	36.6%	49.2%	36.7%	48.2%
Expects to make at least a 'B'	53.6%	71.9%	47.0%	69.5%
Interests and goals: Be financially well-off	51.5%	77.7%	32.8%	61.4%

Interests and goals: Develop meaningful philosophy of life	64.4%	46.7%	65.5%	43.1%
Interests and goals: Helping others in difficulty	57.9%	67.7%	67.5%	71.3%
Interests and goals: Make a theoretical contribution to science	36.8%	46.5%	21.5%	29.2%
Interests and goals: Raising a family	53.1%	71.3%	58.4%	79.6%
Interests and goals: scholar	57.3%	63.5%	54.7%	57.6%
Interests and goals: social activism and helping others in difficulty	38.0%	42.5%	40.8%	42.6%
Interests and goals: artistic endeavors	36.5%	34.7%	34.2%	34.9%
Interests and goals: striving for higher social status	44.8%	49.2%	25.0%	27.6%
Interests and goals: Intrinsic reasons for pursuing education	54.5%	69.0%	57.5%	71.0%
Interests and goals: Extrinsic reasons for pursuing education	44.2%	65.4%	31.6%	49.5%
Degree Aspirations: Aspires to earn a PhD	19.5%	27.1%	12.9%	22.1%
Degree Aspirations: Aspires to earn a medical degree	23.2%	22.0%	7.4%	2.5%
Degree Aspirations: Aspires to earn a non-medical masters	32.1%	35.7%	53.7%	59.9%
Undergraduate enrollment	33.8%	48.1%	23.7%	33.9%
Student to faculty ratio	9.9%	9.7%	9.3%	9.4%
Type of educational institution (University)	50.3%	58.0%	32.2%	37.0%
Type of religious institution	24.3%	26.6%	35.7%	42.7%
Attends Historically Black College	2.0%	2.7%	4.0%	1.2%
Attends a public or private institution	47.8%	2.4%	43.7%	46.0%
Institution is in New England region	9.3%	11.3%	9.0%	16.3%
Institution is in Middle East region	26.4%	18.3%	17.8%	18.6%
Institution is in Great Lakes region	19.8%	15.4%	19.2%	16.1%
Institution is in South East region	17.8%	25.4%	21.8%	21.3%
Institution is in South West region	2.6%	3.6%	4.4%	3.0%
Institution is in Far West region	10.6%	18.0%	11.0%	17.2%

Institution is in Rockies and plains region	8.5%	7.9%	15.8%	7.6%

Table 7 (b): Descriptive Results – <u>STEM teachers and secondary school teachers for 1976 and 2011, overall descriptive data</u> – proportion that identify with a specific independent variable

	STEM TEACHERS		SECONDARY SCHOOL TEACHERS	
	1976 (N=821)	2011 (N=609)	1976 (N=9,839)	2011 (N=6,493)
Sex: Female	49.0%	60.2%	63.7%	62.5%
Race: Identifies as Asian	0.6%	5.3%	0.5%	3.3%
Race: Identifies as Black	5.8%	3.8%	7.7%	5.1%
Race: Identifies as Latino	0.7%	7.6%	1.5%	6.2%
Race: Identifies as Other	2.3%	10.6%	2.2%	9.3%
Race: White	90.6%	72.7%	88.1%	76.2%
Father's education: earned a Bachelor’s degree or higher	38.1%	56.1%	32.7%	51.9%
Mother's education: earned a Bachelor’s degree or higher	23.5%	61.9%	21.6%	55.4%
Parental Income Quintile: household income >= $50K/year	83.5%	85.3%	77.9%	82.9%
Father's occupation is STEM	12.9%	17.0%	10.7%	14.0%
Mother's occupation is STEM	7.9%	14.7%	7.3%	13.4%
Father's occupation is secondary school teaching	7.8%	4.8%	5.7%	4.6%
Mother's occupation is secondary school teaching	3.6%	6.7%	3.5%	7.1%
High school grade point average	86.7%	94.0%	73.8%	90.1%
Self-rated mathematical ability	72.7%	76.6%	25.5%	33.7%
Expects to be a leader	36.7%	48.2%	33.3%	47.3%
Expects to make at least a 'B'	47.0%	69.5%	33.8%	69.1%

Interests and goals: Be financially well-off	32.8%	61.4%	36.9%	64.1%
Interests and goals: Develop meaningful philosophy of life	65.5%	43.1%	65.8%	48.9%
Interests and goals: Helping others in difficulty	67.5%	71.3%	71.9%	76.3%
Interests and goals: Make a theoretical contribution to science	21.5%	29.2%	4.6%	7.7%
Interests and goals: Raising a family	58.4%	79.6%	60.8%	80.7%
Interests and goals: scholar	54.7%	57.6%	35.7%	49.9%
Interests and goals: social activism and helping others in difficulty	40.8%	42.6%	43.4%	46.1%
Interests and goals: artistic endeavors	34.2%	34.9%	45.2%	46.3%
Interests and goals: striving for higher social status	25.0%	27.6%	30.6%	30.8%
Interests and goals: Intrinsic reasons for pursuing education	57.5%	71.0%	59.4%	70.8%
Interests and goals: Extrinsic reasons for pursuing education	31.6%	49.5%	35.4%	53.5%
Degree Aspirations: Aspires to earn a PhD	12.9%	22.1%	11.6%	19.9%
Degree Aspirations: Aspires to earn a medical degree	7.4%	2.5%	0.7%	0.6%
Degree Aspirations: Aspires to earn a non-medical masters	53.7%	59.9%	50.8%	60.4%
Undergraduate enrollment	23.7%	33.9%	27.9%	29.1%
Student to faculty ratio	9.3%	9.4%	12.9%	10.7%
Type of educational institution (University)	32.2%	37.0%	33.5%	29.6%
Type of religious institution	35.7%	42.7%	29.5%	46.5%
Attends Historically Black College	4.0%	1.2%	4.7%	2.0%
Attends a public or private institution	43.7%	46.0%	47.1%	42.8%
Institution is in New England region	9.0%	16.3%	6.3%	13.8%
Institution is in Middle East region	17.8%	18.6%	19.1%	19.1%
Institution is in Great Lakes region	19.2%	16.1%	25.4%	20.9%
Institution is in South East region	21.8%	21.3%	20.5%	21.2%
Institution is in South West region	4.4%	3.0%	5.3%	4.6%

Institution is in Far West region	11.0%	17.2%	9.0%	11.4%
Institution is in Rockies and plains region	15.8%	7.6%	14.3%	9.1%

Table 8: Logistic Regression Results from historical interest in STEM teaching compared to those with an interest in majoring in STEM (1976 and 2011): Main effects model [N=86,984], (Only 1976): [N=42,453], (Only 2011): [N=44,531]

	Exp(B) (p-value)		
	1976 and 2011	**Only 1976**	**Only 2011**
Year is 2011	0.862 (0.069)	n/a	n/a
Sex: Female	2.413 (0.000)	2.395 (0.000)	2.432 (0.000)
Race: Identifies as Asian	0.362 (0.000)	0.171 (0.003)	0.480 (0.002)
Race: Identifies as Black	0.477 (0.001)	0.378 (0.004)	0.553 (0.055)
Race: Identifies as Latino	0.589 (0.008)	0.306 (0.045)	0.751 (0.205)
Race: Identifies as Other	0.813 (0.144)	0.716 (0.267)	0.901 (0.523)
Father's education: earned a Bachelor’s degree or higher	0.925 (0.000)	0.904 (0.000)	0.970 (0.311)
Parental Income Quintile: household income >= $50K/year	0.891 (0.000)	0.888 (0.001)	0.905 (0.020)
Father's occupation is STEM	0.725 (0.004)	0.714 (0.014)	0.745 (0.035)
Mother's occupation is STEM	0.934 (0.522)	0.902 (0.525)	0.922 (0.566)
Father's occupation is secondary school teaching	2.528 (0.000)	2.854 (0.000)	2.130 (0.002)
Mother's occupation is secondary school teaching	1.164 (0.309)	1.023 (0.921)	1.248 (0.273)
High school grade point average	0.935 (0.020)	0.955 (0.207)	0.937 (0.174)
Self-rated mathematical ability	1.354 (0.000)	1.283 (0.000)	1.472 (0.000)
Expects to be a leader	1.214 (0.000)	1.175 (0.004)	1.300 (0.000)
Expects to make at least a 'B'	0.933 (0.265)	0.837 (0.031)	1.049 (0.635)
Interests and goals: Developing meaningful philosophy of life	0.999 (0.971)	1.006 (0.912)	0.990 (0.856)
Interests and goals: Make a theoretical contribution to science	0.675 (0.000)	0.685 (0.000)	0.659 (0.000)
Interests and goals: Raising a family	1.279 (0.000)	1.125 (0.015)	1.563 (0.000)
Interests and goals: scholar	0.859 (0.001)	1.214 (0.001)	0.825 (0.004)
Interests and goals: social activism and helping others in difficulty	1.153 (0.001)	1.214 (0.001)	1.093 (0.149)

Interests and goals: artistic endeavors	1.011 (0.805)	0.949 (0.391)	1.104 (0.117)
Interests and goals: striving for higher social status	0.695 (0.000)	0.723 (0.000)	0.645 (0.000)
Interests and goals: Intrinsic reasons for pursuing education	1.071 (0.068)	1.068 (0.184)	1.102 (0.104)
Interests and goals: Extrinsic reasons for pursuing education	0.803 (0.000)	0.831 (0.000)	0.748 (0.000)
Degree Aspirations: Aspires to earn a PhD	0.889 (0.289)	0.794 (0.141)	1.010 (0.951)
Degree Aspirations: Aspires to earn a medical degree	0.246 (0.000)	0.327 (0.000)	0.137 (0.000)
Degree Aspirations: Aspires to earn a non-medical masters	1.665 (0.000)	1.711 (0.000)	1.648 (0.000)
Undergraduate enrollment	1.000 (0.002)	1.000 (0.021)	1.000 (0.006)
Student to faculty ratio	1.048 (0.000)	1.027 (0.025)	1.116 (0.000)
Type of educational institution	0.645 (0.000)	0.572 (0.000)	0.811 (0.259)
Type of religious institution	1.106 (0.452)	0.954 (0.782)	1.673 (0.020)
Attends Historically Black College	1.336 (0.334)	2.220 (0.054)	0.608 (0.385)
Attends a public or private institution	0.792 (0.074)	0.759 (0.114)	0.987 (0.952)
Institution is in New England region	1.889 (0.000)	1.821 (0.001)	1.359 (0.070)
Institution is in Great Lakes region	1.742 (0.000)	2.397 (0.000)	0.932 (0.680)
Institution is in Far West region	1.936 (0.000)	2.973 (0.000)	0.856 (0.410)
Institution is in South East region	1.849 (0.000)	2.805 (0.000)	0.783 (0.155)
Institution is in Rockies and plains region	2.411 (0.000)	3.588 (0.000)	1.017 (0.931)
Institution is in South West region	2.350 (0.000)	3.702 (0.000)	0.936 (0.821)

Goodness of fit Statistics (1976 and 2011): -2 Log likelihood = 9624.826, Cox & Snell R-square:0.016, Nagelkerke R-square = 0.136
Goodness of fit Statistics (1976): -2 Log likelihood = 5293.766, Cox & Snell R-square:0.019, Nagelkerke R-square = 0.140
Goodness of fit Statistics (2011): -2 Log likelihood = 4199.786, Cox & Snell R-square:0.016, Nagelkerke R-square = 0.155

Table 9: Logistic Regression Results for historical interest in STEM teaching compared to those with an interest in secondary school teaching (1976 and 2011): Main effects model [N= 11,314] , (Only 1976): [N=6,413], (Only 2011): [N=4,901]

	Exp (B) (p-value)		
	1976 and 2011	**Only 1976**	**Only 2011**
Year is 2011	0.666 (0.000)	n/a	n/a
Sex: Female	0.929 (0.370)	0.726 (0.005)	1.314 (0.028)
Race: Identifies as Asian	0.960 (0.879)	0.361 (0.216)	0.909 (0.751)
Race: Identifies as Black	1.092 (0.730)	1.027 (0.944)	1.277 (0.504)
Race: Identifies as Latino	1.245 (0.365)	0.604 (0.485)	1.198 (0.523)
Race: Identifies as Other	1.330 (0.097)	1.202 (0.641)	1.371 (0.106)
Father's education: earned a Bachelor’s degree or higher	1.058 (0.009)	1.046 (0.119)	1.097 (0.008)
Parental Income Quintile: household income >= $50K/year	1.019 (0.563)	1.016 (0.712)	1.030 (0.565)
Father's occupation is STEM	0.917 (0.455)	0.882 (0.446)	0.926 (0.644)
Mother's occupation is STEM	0.976 (0.847)	1.014 (0.943)	0.957 (0.793)
Father's occupation is secondary school teaching	0.957 (0.794)	0.924 (0.725)	0.991 (0.975)
Mother's occupation is secondary school teaching	0.810 (0.232)	0.882 (0.657)	0.754 (0.219)
High school grade point average	1.152 (0.000)	1.147 (0.002)	1.144 (0.013)
Self-rated mathematical ability	2.694 (0.000)	2.825 (0.000)	2.583 (0.000)
Expects to be a leader	0.957 (0.356)	0.956 (0.500)	0.974 (0.708)
Expects to make at least a 'B'	0.917 (0.235)	0.854 (0.113)	0.999 (0.994)
Interests and goals: Developing meaningful philosophy of life	0.991 (0.842)	1.019 (0.767)	0.970 (0.651)
Interests and goals: Make a theoretical contribution to science	3.671 (0.000)	3.939 (0.000)	3.536 (0.000)
Interests and goals: Raising a family	1.028 (0.527)	0.993 (0.899)	1.096 (0.199)
Interests and goals: scholar	0.961 (0.448)	1.030 (0.693)	0.904 (0.185)
Interests and goals: social activism and helping others in difficulty	0.738 (0.000)	0.781 (0.001)	0.660 (0.000)
Interests and goals: artistic endeavors	0.622 (0.000)	0.591 (0.001)	0.672 (0.000)

Interests and goals: striving for higher social status	0.805 (0.000)	0.731 (0.000)	0.909 (0.222)
Interests and goals: Intrinsic reasons for pursuing education	1.053 (0.232)	1.070 (0.240)	1.046 (0.513)
Interests and goals: Extrinsic reasons for pursuing education	0.971 (0.473)	0.992 (0.875)	0.925 (0.260)
Degree Aspirations: Aspires to earn a PhD	0.892 (0.385)	0.685 (0.048)	0.982 (0.927)
Degree Aspirations: Aspires to earn a medical degree	5.575 (0.000)	8.123 (0.000)	2.811 (0.023)
Degree Aspirations: Aspires to earn a non-medical masters	1.058 (0.550)	1.090 (0.475)	0.958 (0.788)
Undergraduate enrollment	1.000 (0.015)	1.000 (0.001)	1.000 (0.704)
Student to faculty ratio	0.982 (0.195)	1.011 (0.543)	0.938 (0.004)
Type of educational institution	1.166 (0.224)	1.133 (0.485)	1.248 (0.291)
Type of religious institution	1.017 (0.916)	0.964 (0.860)	1.252 (0.373)
Attends Historically Black College	0.935 (0.845)	0.857 (0.737)	0.748 (0.649)
Attends a public or private institution	1.154 (0.367)	0.929 (0.732)	1.639 (0.052)
Institution is in New England region	1.408 (0.017)	1.171 (0.479)	1.611 (0.016)
Institution is in Great Lakes region	0.813 (0.103)	0.827 (0.265)	0.770 (0.184)
Institution is in Far West region	1.757 (0.000)	1.282 (0.236)	2.370 (0.000)
Institution is in South East region	1.284 (0.046)	1.230 (0.232)	1.229 (0.278)
Institution is in Rockies and plains region	1.136 (0.357)	1.098 (0.599)	1.041 (0.864)
Institution is in South West region	0.852 (0.449)	0.815 (0.473)	0.737 (0.374)

Goodness of fit Statistics (1976 and 2011): -2 Log likelihood = 5036.738, Cox & Snell R-square: 0.147, Nagelkerke R-square = 0.324
Goodness of fit Statistics (1976): -2 Log likelihood = 2739.908, Cox & Snell R-square:0.162, Nagelkerke R-square = 0.358
Goodness of fit Statistics (2011): -2 Log likelihood = 2218.717, Cox & Snell R-square:0.140, Nagelkerke R-square = 0.308

Table 10: Logistic regression results for gender specific parent – student associations over time (1976 and 2011)

Here I was interested in measuring student interest in STEM teaching versus STEM major based on having parents that had STEM occupations or parents that had secondary school teaching occupations. I also wanted to know if the impact differed based on gender of parent and gender of student.

Outcome: STEM Teacher vs STEM majors w/ STEM parents

	Father-Son	**Mother-Son**	**Father-daughter**	**Mother-daughter**
Zero order model	0.642 (0.000)	0.915 (0.205)	0.685 (0.000)	0.92 (0.175)
Final model	1.180 (0.567)	1.043 (0.895)	0.985 (0.954)	1.016 (0.958)
% explained	11.9	11.9	18.8	18.8
%unexplained	88.1	88.1	81.2	81.2

Outcome: STEM Teacher vs STEM majors w/ Sec Ed parents

	Father-Son	**Mother-Son**	**Father-daughter**	**Mother-daughter**
Zero order model	2.798 (0.000)	1.117 (0.251)	1.487 (0.000)	1.092 (0.339)
Final model	0.525 (0.138)	1.074 (0.870)	1.253 (0.611)	1.401 (0.448)
% explained	11.9	11.9	18.8	18.8
%unexplained	88.1	88.1	81.2	81.2

Here I was interested in measuring student interest in STEM teaching versus secondary school teaching based on having parents that had STEM occupations or parents that had secondary school teaching occupations. I also wanted to know if the impact differed based on gender of parent and gender of student.

	Outcome: STEM Teacher vs Secondary School Teacher w/ STEM parents			
	Father-Son	**Mother-Son**	**Father-daughter**	**Mother-daughter**
Zero order model	1.439 (0.000)	1.032 (0.672)	1.328 (0.000)	1.227 (0.001)
Final model	1.485 (0.273)	0.823 (0.619)	0.769 (0.403)	1.104 (0.779)
% explained	35.9	35.9	34.1	34.1
%unexplained	64.1	64.1	65.9	65.9

	Outcome: STEM Teacher vs Secondary School Teacher w/ Sec Ed parents			
	Father-Son	**Mother-Son**	**Father-daughter**	**Mother-daughter**
Zero order model	1.41 (0.000)	0.92 (0.410)	0.99 (0.992)	1.03 (0.755)
Final model	0.807 (0.690)	0.848 (0.762)	1.297 (0.597)	0.853 (0.759)
% explained	35.9	35.9	34.1	34.1
%unexplained	64.1	64.1	65.9	65.9

Appendix A

Table 11: Logistic Regression Results – Interest in STEM teaching compared to those with an interest in majoring in STEM subjects for 2011 data: Full model with gender interactions [N=44,531]

	Exp (B) (p-value)
Sex: Female	0.878 (0.925)
Race: Identifies as Asian	0.263 (0.122)
Race: Identifies as Black	0.448 (0.444)
Race: Identifies as Latino	0.677 (0.612)
Race: Identifies as Other	0.700 (0.534)
Father's education: earned a Bachelor's degree or higher	0.929 (0.467)
Parental Income Quintile: household income >= $50K/year	0.823 (0.187)
Father's occupation is STEM	1.193 (0.705)
Mother's occupation is STEM	0.963 (0.937)
Father's occupation is secondary school teaching	1.752 (0.486)
Mother's occupation is secondary school teaching	1.105 (0.884)
High school grade point average	0.720 (0.028)
Self-rated mathematical ability	1.006 (0.979)
Expects to be a leader	1.121 (0.570)
Expects to make at least a 'B'	1.001 (0.997)
Interests and goals: Developing meaningful philosophy of life	0.797 (0.243)
Interests and goals: Make a theoretical contribution to science	1.210 (0.363)
Interests and goals: Raising a family	1.688 (0.014)

Interests and goals: scholar	0.970 (0.893)
Interests and goals: social activism and helping others in difficulty	1.047 (0.828)
Interests and goals: artistic endeavors	1.375 (0.128)
Interests and goals: striving for higher social status	0.474 (0.001)
Interests and goals: Intrinsic reasons for pursuing education	1.130 (0.531)
Interests and goals: Extrinsic reasons for pursuing education	0.975 (0.901)
Degree Aspirations: Aspires to earn a PhD	4.722 (0.005)
Degree Aspirations: Aspires to earn a medical degree	0.271 (0.310)
Degree Aspirations: Aspires to earn a non-medical masters	2.455 (0.061)
Undergraduate enrollment	1.000 (0.977)
Student to faculty ratio	1.105 (0.110)
Type of educational institution	1.835 (0.350)
Type of religious institution	11.601 (0.002)
Attends Historically Black College	3.728 (0.479)
Attends a public or private institution	1.204 (0.802)
Institution is in New England region	0.949 (0.925)
Institution is in Great Lakes region	0.443 (0.145)
Institution is in Far West region	0.233 (0.030)
Institution is in South East region	0.174 (0.005)
Institution is in Rockies and plains region	0.771 (0.688)
Institution is in South West region	0.885 (0.898)

Interests and goals: Make a theoretical contribution to science * Sex	0.683 (0.002)
Degree Aspirations: PhD * Sex	0.373 (0.004)
Type of religious institution * Sex	0.299 (0.009)
Institution is in Far West region * Sex	2.198 (0.047)
Institution is in South East region * Sex	2.437 (0.014)

Goodness of fit Statistics: -2 Log likelihood = 4135.477, Cox & Snell R-square: 0.018, Nagelkerke R-square = 0.169

Table 12: Logistic Regression Results – Interest in STEM teaching compared to those with an interest in secondary school teaching for 2011 data: Full model with gender interactions [N=4,901]

	Exp (B) (p-value)
Sex: Female	0.202 (0.345)
Race: Identifies as Asian	0.196 (0.171)
Race: Identifies as Black	1.476 (0.758)
Race: Identifies as Latino	1.157 (0.883)
Race: Identifies as Other	1.224 (0.773)
Father's education: earned a Bachelor's degree or higher	1.045 (0.710)
Parental Income Quintile: household income >= $50K/year	0.934 (0.705)
Father's occupation is STEM	1.657 (0.381)
Mother's occupation is STEM	0.607 (0.384)
Father's occupation is secondary school teaching	0.269 (0.169)
Mother's occupation is secondary school teaching	1.396 (0.678)
High school grade point average	0.880 (0.464)
Self-rated mathematical ability	2.015 (0.003)
Expects to be a leader	0.857 (0.521)
Expects to make at least a 'B'	1.154 (0.723)
Interests and goals: Developing meaningful philosophy of life	0.732 (0.189)
Interests and goals: Make a theoretical contribution to science	3.327 (0.000)
Interests and goals: Raising a family	1.296 (0.301)
Interests and goals: scholar	1.144 (0.610)

Interests and goals: social activism and helping others in difficulty	0.570 (0.037)
Interests and goals: artistic endeavors	0.694 (0.121)
Interests and goals: striving for higher social status	1.089 (0.754)
Interests and goals: Intrinsic reasons for pursuing education	0.927 (0.737)
Interests and goals: Extrinsic reasons for pursuing education	1.228 (0.402)
Degree Aspirations: Aspires to earn a PhD	1.711 (0.419)
Degree Aspirations: Aspires to earn a medical degree	1.174 (0.931)
Degree Aspirations: Aspires to earn a non-medical masters	0.848 (0.767)
Undergraduate enrollment	1.000 (0.336)
Student to faculty ratio	0.903 (0.207)
Type of educational institution	4.020 (0.064)
Type of religious institution	5.594 (0.064)
Attends Historically Black College	11.723 (0.258)
Attends a public or private institution	2.994 (0.229)
Institution is in New England region	1.882 (0.343)
Institution is in Great Lakes region	0.333 (0.092)
Institution is in Far West region	0.396 (0.289)
Institution is in South East region	0.212 (0.026)
Institution is in Rockies and plains region	0.961 (0.959)
Institution is in South West region	1.621 (0.668)
Institution is in Far West region * Sex	2.915 (0.034)

Institution is in South East region * Sex	2.851 (0.010)

Goodness of fit Statistics: -2 Log likelihood = 2173.976, Cox & Snell R-square: 0.147, Nagelkerke R-square = 0.326

Appendix B

Table 13: Logistic Regression Results over time – Historical interest in STEM teaching compared to those with an interest in majoring in STEM (1976 and 2011): Full model with year interactions [N=86,984]

	Exp (B) (p-value)
Sex: Female	2.395 (0.000)
Year is 2011	0.029 (0.000)
Race: Identifies as Asian	0.171 (0.003)
Race: Identifies as Black	0.378 (0.004)
Race: Identifies as Latino	0.306 (0.045)
Race: Identifies as Other	0.716 (0.267)
Father's education: earned a Bachelor's degree or higher	0.904 (0.000)
Parental Income Quintile: household income >= $50K/year	0.888 (0.001)
Father's occupation is STEM	0.714(0.0144)
Mother's occupation is STEM	0.902 (0.525)
Father's occupation is secondary school teaching	2.854 (0.000)
Mother's occupation is secondary school teaching	1.023 (0.921)
High school grade point average	0.955 (0.207)
Self-rated mathematical ability	1.283 (0.000)
Expects to be a leader	1.175 (0.004)
Expects to make at least a 'B'	0.837 (0.031)
Interests and goals: Developing meaningful philosophy of life	1.006 (0.912)
Interests and goals: Make a theoretical contribution to science	0.685 (0.000)
Interests and goals: Raising a family	1.125 (0.015)
Interests and goals: scholar	0.900 (0.096)

Interests and goals: social activism and helping others in difficulty	1.214 (0.001)
Interests and goals: artistic endeavors	0.949 (0.391)
Interests and goals: striving for higher social status	0.723 (0.000)
Interests and goals: Intrinsic reasons for pursuing education	1.068 (0.184)
Interests and goals: Extrinsic reasons for pursuing education	0.831 (0.000)
Degree Aspirations: Aspires to earn a PhD	0.794 (0.141)
Degree Aspirations: Aspires to earn a medical degree	0.327 (0.000)
Degree Aspirations: Aspires to earn a non-medical masters	1.711 (0.000)
Undergraduate enrollment	1.000 (0.021)
Student to faculty ratio	1.027 (0.025)
Type of educational institution	0.572 (0.000)
Type of religious institution	0.954 (0.782)
Attends Historically Black College	2.220 (0.054)
Attends a public or private institution	0.759 (0.114)
Institution is in New England region	1.821 (0.001)
Institution is in Great Lakes region	2.397 (0.000)
Institution is in Far West region	2.973 (0.000)
Institution is in South East region	2.805 (0.000)
Institution is in Rockies and plains region	3.588 (0.000)
Institution is in South West region	3.702 (0.000)
Interests and goals: Raising a family * Year is 2011	1.390 (0.000)
Student to faculty ratio * Year 2011	1.088 (0.000)
Type of religious institution* Year 2011	1.754 (0.045)
Degree Aspirations: To earn a MD* Year is 2011	0.418 (0.018)
Institution is in Great Lakes region* Year is 2011	0.389 (0.000)
Institution is in South East region* Year is 2011	0.279 (0.000)
Institution is in South West region* Year is 2011	0.253 (0.000)

Institution is in Far West region * Year is 2011	0.288 (0.000)
Institution is in Rockies and plains region * Year is 2011	0.284 (0.000)

Goodness of fit Statistics: -2 Log likelihood = 9493.552, Cox & Snell R-square: 0.018, Nagelkerke R-square = 0.149

Table 14: Logistic Regression Results over time – Historical interest in STEM teaching compared to those with an interest in secondary school teaching (1976 and 2011): Full model with year interactions [N=11,314]

Sex: Female	0.726 (0.005)
Year is 2011	0.257 (0.188)
Race: Identifies as Asian	0.361 (0.216)
Race: Identifies as Black	1.027 (0.944)
Race: Identifies as Latino	0.604 (0.485)
Race: Identifies as Other	1.202 (0.641)
Father's education: earned a Bachelor's degree or higher	1.046 (0.119)
Parental Income Quintile: household income >= $50K/year	1.016 (0.712)
Father's occupation is STEM	0.882 (0.446)
Mother's occupation is STEM	1.014 (0.943)
Father's occupation is secondary school teaching	0.924 (0.725)
Mother's occupation is secondary school teaching	0.882 (0.657)
High school grade point average	1.147 (0.002)
Self-rated mathematical ability	2.825 (0.000)
Expects to be a leader	0.956 (0.500)
Expects to make at least a 'B'	0.854 (0.113)
Interests and goals: Developing meaningful philosophy of life	1.019 (0.767)
Interests and goals: Make a theoretical contribution to science	3.939 (0.000)
Interests and goals: Raising a family	0.993 (0.899)
Interests and goals: scholar	1.030 (0.693)
Interests and goals: social activism and helping others in difficulty	0.781 (0.001)
Interests and goals: artistic endeavors	0.591 (0.000)
Interests and goals: striving for higher social status	0.731 (0.000)
Interests and goals: Intrinsic reasons for pursuing education	1.070 (0.240)

Interests and goals: Extrinsic reasons for pursuing education	0.992 (0.875)
Degree Aspirations: Aspires to earn a PhD	0.685 (0.048)
Degree Aspirations: Aspires to earn a medical degree	8.123 (0.000)
Degree Aspirations: Aspires to earn a non-medical masters	1.090 (0.475)
Undergraduate enrollment	1.000 (0.001)
Student to faculty ratio	1.011 (0.543)
Type of educational institution	1.133 (0.485)
Type of religious institution	0.964 (0.860)
Attends Historically Black College	0.857 (0.737)
Attends a public or private institution	0.929 (0.732)
Institution is in New England region	1.171 (0.479)
Institution is in Great Lakes region	0.827 (0.265)
Institution is in Far West region	1.282 (0.236)
Institution is in South East region	1.230 (0.232)
Institution is in Rockies and plains region	1.098 (0.599)
Institution is in South West region	0.815 (0.473)
Sex * Year is 2011	1.809 (0.000)
Interests and goals: Identifies as striving for higher social status* Year is 2011	1.244 (0.037)
Undergraduate enrollment* Year is 2011	1.045 (0.014)
Student to faculty ratio* Year is 2011	0.928 (0.009)

Goodness of fit Statistics: -2 Log likelihood = 4958.625, Cox & Snell R-square: 0.153, Nagelkerke R-square = 0.336

Appendix C

Table 15: Of all students in HERI sample, percentage in groups of interest

	1976	1986	1996	2006	2011
Of all students % STEM majors	19.6	17.1	17.6	17.7	22.5
Of all students % STEM teachers	0.3	0.3	0.3	0.3	0.2
Of all students % secondary school teachers	3.1	2.8	3.8	3.7	2.7

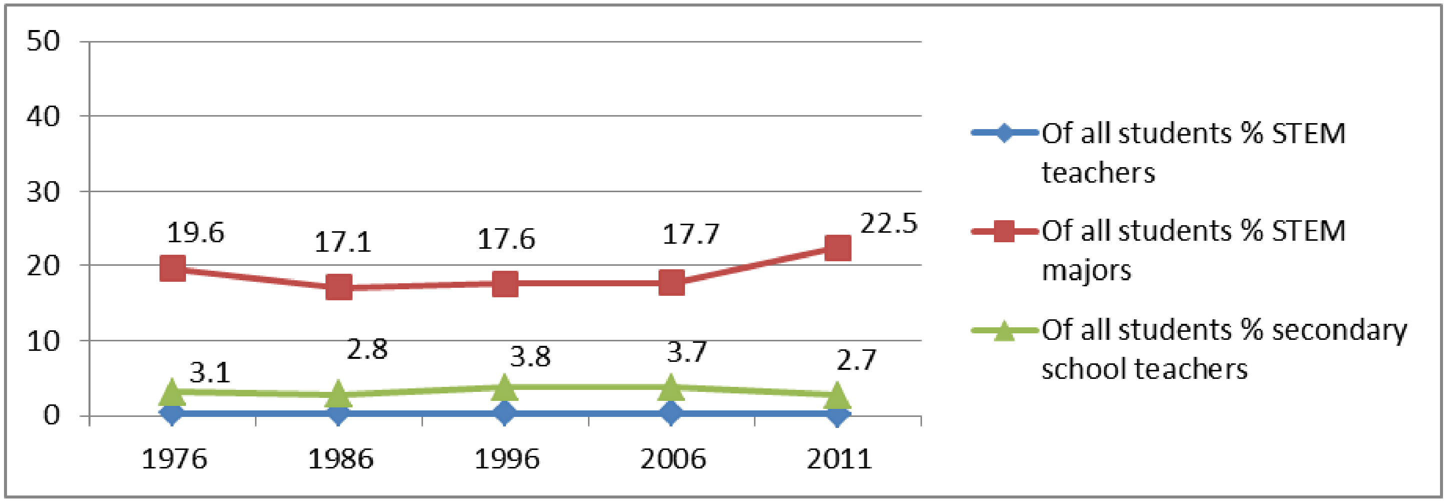

Figure 3: Of all students in HERI sample, percentage in groups of interest

Appendix D

Table 16: Racial composition of US population (census data) and representation among first year college students (HERI sample data) by year

	Census data (%)		HERI data (%)	
	1970	**2010**	**1976**	**2011**
Asians	0.8	4.9	1.8	9.4
Latinos	4.4	16.3	1.6	7.7
Blacks	11.1	12.6	9.5	8.5
Others	0.1	6.2	1.5	1.6
Whites	87.7	72.4	84.1	62.4

Source: U.S. Census bureau data and HERI dataset

REFERENCES

A*CT Research and Policy*. (2013, June). Retrieved November 15, 2013, from STEM Educator Pipline: Doing the Math on Recruiting Math and Science Teachers: http://www.act.org/research/policymakers/pdf/STEM-Educator-Pipeline.pdf

Adachi, T. (2004). Career self-efficacy, career outcome expectations and vocational interests among Japanese university students. Psychological Reports, 95, 89 – 100.

Ahmad, S. (2016). Family or Future in the Academy. *Review of Educational Research*, 1-36.

Allison, P. D. (2001). Logistic regression using the SAS System: Theory and application. Cary, NC: SAS Publishing. ISBN 1-58025-352-0.

Allison, P. (2012). *Categorical Data Analysis Lecture Notes*. University of Pennsylvania, Philadelphia, PA.

Andrew, M., & Schwab, R. L. (1995). Has reform in teacher education influenced teacher performance? An outcome assessment of graduates of eleven teacher education programs. *Action in Teacher Education*, 43-53.

Astin, A.W., & Oseguera, L. (2004). The declining "equity" of American higher education. The *Review of Higher Education*, 27, 3: 321-341.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Bandura, A. (2006). Toward a psychology of human agency. Perspectives on Psychological Science, 1, 164–180.

Biblarz, T.J. & Raftery, A.E. (1999). Family structure, educational attainment, and socioeconomic success: Rethinking the "pathology of matriarchy." *American Journalof Sociology, 105,* 321–365.

Betts, Julian R., & Darlene Morell (1999), The Determinants of Undergraduate GPA: The Relative Importance of Family Background, High School Resources, and Peer Group Effects, *Journal of Human Resources*, XXXIV, 268 –293.

Blanco, A. (2011). Applying social cognitive career theory to predict interests and choice goals in statistics among Spanish psychology students. *Journal of Vocational Behavior, 78,* 49–58.

Boggess, S. (1998). Family structure, economic status, and educational attainment. *Journal of Population Economics, 11*, 205–222.

Brown, S. D., & Lent, R. W. (1996). A social cognitive framework for career choice counseling. *Career Development Quarterly*, *44*, 354–366.

Brown, S. D., Tramayne, S., Hoxha, D., Telander, K., Fan, X., & Lent, R. W. (2008). Social cognitive predictors of college students' academic performance and persistence: A meta-analytic path analysis. *Journal of Vocational Behavior*, *72*(3), 298-308.

Byars-Winston, A., Estrada, Y., Howard, C., Davis, D., & Zalapa, J. (2010). Influence of social cognitive and ethnic variables on academic goals of underrepresented students in science and engineering: a multiple-groups analysis. *Journal of counseling psychology*, *57*(2), 205.

Chang, E. (2013, September 11). *Choose the right undergraduate major for medical school*. Retrieved from US News and World Report: Education: http://www.usnews.com/education/blogs/medical-school-admissions-doctor/2013/09/11/choose-the-right-undergraduate-major-for-medical-school

College Board (2008). 2008 College-Bound Seniors: Total Group Profile Report. New York.

Conley, D. (2001). Capital for college: Parental assets and postsecondary schooling. Sociology of Education, 74, 59–72.

Corcoran, M.E., & Courant, P.N. (1985). Sex role socialization and labor market outcomes. *American Economic Review, 75*, 275–278.

Darling-Hammond, L. (1998). Teachers and Teaching: Testing Policy Hypotheses from a National Commission Report. *Educational Researcher*, 5-15.

Darling-Hammond, L., & Ducommun, C. E. (2007). *Recruiting and Retaining Teachers: What Matters Most and What Can Government Do?* Retrieved September 16, 2013, from The Forum for Education and Democracy: http://www.forumforeducation.org/news/recruiting-and-retaining-teachers-what-matters-most-and-what-can-government-do

Darling-Hammond, L., & Youngs, P. (2002). Defining "Highly Qualified Teachers": What Does "Scientifically-Based Research" Actually Tell Us? *Educational Researcher*, 13-25.

Davies, S., & Guppy, N. (1997). Fields of study, college selectivity, and student Inequalities in higher education. *Social Forces, 75,* 1417–1438.

Dawson-Threat, J., & Huba, M.E. (1996). Choice of major and clarity of purpose among college seniors as a function of gender, type of major, and sex-role identification. *Journal of College Student Development*, *37,* 297–308.

Diegelman, N., & Subich, L. (2001). Academic and vocational interests as a function of outcome expectancies in Social Cognitive Career Theory. *Journal of Vocational Behavior*, 59, 349 − 405.

Eagan, K. (2013). UCLA Higher Education Research Institute American Freshman Survey technical team.

Ferry, T., Fouad, N., & Smith, P. (2000). The role of family context in a social cognitive Model for career-related choice behavior: a math and science perspective. *Journal of Vocational Behavior*, 57, 348−364.

Green, K. C. (1992). *After the boom: Management majors in the 1990s.*New York: McGraw-Hill.

Guarino, C. M., Santibanez, L., & Daley, G. A. (2006). Teacher Recruitment and Retention: A Review of the Recent Empirical Literature. *Review of Educational Review*, 173-208.

Hackett, G. (1985). The role of mathematics self-efficacy in the choice of math-related majors of college women and men: A path analysis. *Journal of Counseling Psychology*, *32*, 47-56.

Hackett, G. (2013). *Social Cognitive Career Theory of Career Choice.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CCkQFjAA&url=http%3A%2F%2Fwww.umkc.edu%2Fprovost%2Fstudent-retention%2Fdocuments%2FSocial%2520Cognitive%2520Career%2520Theory%2520February%25202013.ppt&ei=wC6xUpzBDqLmsASnwoC4Ag&usg=AFQjC

Hackett, G., Esposito, D., & O'Halloran, M.S. (1989). The relationship of role model influences to the career salience and educational and career plans of college women. *Journal of Vocational Behavior, 35,* 164–180.

Hackett, G., & Lent, R.W. (2008). Social cognitive theory. In F. T. L. Leong (Editor-in-Chief), H.E.A.Tinsley (Senior Editor) & S.H. Lease (Associate Editor), *Encyclopedia of counseling, Volume 2:Personal and emotional counseling*. (pp. 767-769). Thousand Oaks, CA: Sage Publications.

Hanushek, E. A. (1999). Some Findings From an Independent Investigation of the Tennessee STAR Experiment and From Other Investigations of Class Size Effects. *Educational Evaluation and Policy Analysis*, 143-163.

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2004). Why public schools lose teachers. *Journal of Human Resources, 39(2),* 326-354.

Hanushek, E., & Pace, R. (1995). Who chooses to teach (and why)? Economics of Education Review, 14(2), 101–117.

Henry, G. T., Bastian, K. C., & Smith, A. A. (2012). Scholarships to Recruit the "Best and Brightest" Into Teaching: Who Is Recruited, Where Do They Teach, How Effective Are They, and How Long Do They Stay? *Educational Researcher*, 83-92.

Hill, M.S., & Duncan, G.J. (1987). Parental family income and the socioeconomic Attainment of children. *Social Science Research, 16,* 39–73.

Hosmer Jr, D. W., Lemeshow, S., & Sturdivant, R. X. (2013). *Applied logistic regression*. Wiley.

Ingersoll, R. M. (1999). The Problem of Underqualified Teachers in American Secondary Schools. *Educational Researcher*, 26-37.

Ingersoll, R. M. (2001). *Teacher Turnover, Teacher Shortages, and the Organization of Schools.* Center for the Study of Teaching and Policy: University of Washington.

Ingersoll, R. M. (2007). *Misdiagnosing the Teacher Quality Problem.* Philadelphia: CPRE Policy Briefs.

Ingersoll, R., & Perda, D. (2010). Is the supply of mathematics and science teachers sufficient? American Educational Research Journal, 47(3), 563–595.

Ingersoll, R., & Merrill, L. (2010). Who's Teaching Our Children? *Educational Leadership*, 14-20.

Ishitani TT (2006) Studying attrition and degree completion behavior among first-generation college students in the United States. *Journal of Higher Education*, 77 (5):861–885.

Jacobs, J. (2015). Personal communication. Philadelphia, PA, USA.

Kochanek, J. (2015, February 18). Personal communication. Chicago, IL, USA.

Kinzie, J. (2007). Women's paths in science: A critical feminist analysis. *New Directions for Institutional Research, 133*, 81-93.

Laczko-Kerr, I., & Berliner, D. (2002). The Effectiveness of "Teach for America" and Other Under-certified Teachers. *Education Policy Analysis Archives*, *10*, 37. Retrieved from http://epaa.asu.edu/ojs/article/view/316

Lent, R.W. (2013). Social cognitive career theory (pp. 115- 146). In S.D. Brown & R. W. Lent (Eds.), *Career development & counseling: Putting theory and research to work* (2nd Ed.). New York: Wiley.

Lent, R. W., Brown, S. D., Brenner, B., Batra, S., Davis, T., Talleyrand, R., et al. (2001). The role of contextual supports and barriers in the choice of math/science educational options: a test of social cognitive hypotheses. Journal of Counseling Psychology, 48, 474−483.

Lent, R.W., Brown, S.D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of Counseling Psychology, 47*, 36-49.

Lent, R. W., Brown, S.D. & Hackett, G. (1994). Toward a unified social cognitive theory of career/academic interest, choice, and performance. *Journal of Vocational Behavior* [Monograph], *45*, 79-122.

Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of contextual supports and barriers to choice behavior in engineering majors: test of alternative social cognitive models. Journal of Counseling Psychology, 50, 458−465.

Lent, R. W., Brown, S. D., Sheu, H., Schmidt, J., Brenner, B., Gloster, C., et al. (2005). Social cognitive predictors of academic interest and goals in engineering: utility for women and students at historically black universities. Journal of Counseling Psychology, 52, 84−92.

Lent, R. W., Lopez, F., & Bieschke, K. (1991). Mathematics self-efficacy: Sources and relation to science-based career choice. Journal of Counseling Psychology, 38, 424-430.

Lent, R. W., Lopez, A. M., Lopez, F. G., & Sheu, H. (2008). Social cognitive career theory and the prediction of interests and choice goals in the computing disciplines. Journal of Vocational Behavior, 73, 52−62.

Lent, R. W., Sheu, H.-B., Gloster, C. S., & Wilkins, G. (2010). Longitudinal test of the social cognitive model of choice in engineering students at historically Black universities. *Journal of Vocational Behavior*, 387-394.

Leppel, K., Williams, M. L., & Waldauer, C. (2001). The impact of parental occupation and socioeconomic status on choice of college major. *Journal of Family and Economic issues*, *22*(4), 373-394.

Levy, D., & Duncan, G. (2000), Using Siblings to Assess the Effect of Childhood Family Income on Completed Schooling, Joint Centre for Poverty Research Working Paper, North Western University.

Li, L. (2012). *Improving Teacher Quality in the United States.* Boston: Harvard Graduate School of Education.

Loy, K. (2006). *Effective teacher communication skills and teacher quality.* (Electronic Thesis or Dissertation). Retrieved from https://etd.ohiolink.edu/

Malgwi, C. A., Howe, M. A., & Burnaby, P. A. (2005). Influences on students' choice of college major. *Journal of Education for Business*, *80*(5), 275-282.

Mayer, S. (1997), What Money Can’t Buy: Family Income and Children’s Life Chances, Cambridge, MA, Harvard University Press.

Murnane, R. J., & Steele, J. L. (2007). What is the problem? The challenge of providing effective teachers for all children. *The Future of Children*, *17*(1), 15-43.

Newsom, J. T. (2005). More on Model Fit and Significance of Predictors with Logistic Regression.

Özyürek, R. (2005). Informative sources of math-related self-efficacy expectations and their relationship with math-related self-efficacy, interest, and preference. *International Journal of Psychology*, 40, 145–156.

Podgursky, M., Monroe, R., & Watson, D. (2004). The academic quality of public school teachers: An analysis of entry and exit behavior. Economics of Education Review, 23, 507–518.

Pryor, J. H., Eagan, K., Palucki Blake, L., Hurtado, S., Berdan, J., & Case, M. H. (2012). The American freshman: National norms fall 2012. Los Angeles: Higher Education Research Institute, UCLA.

Rinke, C. R. (2008). *Understanding teachers' careers: linking professional life to professional path. Educational Research Review, 3, 1–13.*

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, Schools, and Academic Achievement. *Econometrica*, 417-458.

Rowe, K. (2003). *Building Teacher Quality: What does research tell us?* Australian Council for Educational Research.

Sandefur, G.D., McLanahan, S., & Wojtkiewicz, R.A. (1992). The effects of parental marital status during adolescence on high school graduation. *Social Forces, 71,* 103–121.

Sandefur, G.D., & Wells, T. (1999). Does family structure really influence educational attainment? *Social Science Research, 28,* 331–357.

Sanders, W. L., & Rivers, J. C. (1996). *Cumulative and Residual Effects of Teachers on Future Student Academic Achievement.* Knoxville: University of Tennessee Value-Added Research and Asessment Center.

Sax, L. J. (1994). Retaining tomorrow's scientists: Exploring the factors that keep male and female college students interested in science careers. *Journal of Women and Minorities in Science and Engineering, 1,* 45-61.

Sax, L. J. (1995). Predicting gender and major-field differences in mathematical self-concept during college. *Journal of Women and Minorities in Science and Engineering, 1*(4), 291-307.

Sax, L. J. (2001). Undergraduate science majors: Gender differences in who goes to graduate school. *The Review of Higher Education, 24*(2), 153-172.

Sax, L. J., Jacobs, J., & Riggers, T. (2010). Women's Representation in Science and Technology (STEM) Fields of Study, 1976-2006. In *annual meeting of the Association for the Study of Higher Education (ASHE), November 2010, Indianapolis, Indiana*.

Schaub, M., & Tokar, D. (2005). The role of personality and learning experiences in social cognitive career theory. Journal of Vocational Behavior, 66, 304-325.

Sheu, H., Lent, R. W., Brown, S. D., Miller, M. J., Hennessy, K. D., & Duffy, R. D. (2010). Testing the choice model of social cognitive career theory across Holland themes : a meta-analytic path analysis. *Journal of Vocational Behavior, 76*, 252–264.

Slaney, R.B., & Brown, M.T. (1983). Effects of race and socioeconomic status on career choice variables among college men. *Journal of Vocational Behavior, 23,* 257–269.

Trusty, J., Robinson, C.R., Plata, M., & Ng, K. (2000). Effects of gender, socioeconomic status, and early academic performance on postsecondary educational choice. *Journal of Counseling and Development, 78,* 463–472.

Tucker, M.S. (2011) How the top performers got there: Analysis and synthesis. In Tucker, M.S. (Ed.*) Surpassing Shanghai: An agenda for American education built on the world's leading systems.*

UCLA IDRE: Institute for Digital Research and Education. (n.d.). Retrieved October 25, 2013, from Logistic Regression: http://www.ats.ucla.edu/stat/spss/topics/logistic_regression.htm

U.S. Census Bureau (2016, May 15). Retrieved from United States Census Bureau: https://www.census.gov/newsroom/cspan/1940census/CSPAN_1940slides.pdf

Ware, N.C., & Lee, V.E. (1988). Sex differences in choice of college science majors. *American Educational Research Journal, 25,* 593–614.

Ware, N.C., Steckler, N.A., & Leserman, J. (1985). Undergraduate women: Who chooses a science major? *Journal of Higher Education, 56,* 73–84.R

White House: Report to the President. (2012, February). Retrieved November 15, 2013, from
Engage to Excel: Producing One Million Additional College Graduates With Degrees in Science, Technology, Engineering, and Mathematics: http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-executive-report-final_2-13-12.pdf