

**OPENING THE PIPELINE FOR SCIENCE, TECHNOLOGY, ENGINEERING,
AND MATHEMATICS HEALTH EDUCATION: PERCEPTIONS OF
TEACHER PREPARATORY PROGRAM PARTICIPANTS**

A Dissertation

by

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ABSTRACT

It is undeniably obvious that the United States has fallen behind many other industrialized countries in terms of STEM education of its citizenry. While many explanations, rationales, and solutions have been offered in the pursuit of resolution, along with a litany of research into the topic, little research has examined the preconceived notions or perceptions of pre-service teachers; especially of those who have committed to working in high-need schools/districts and with a diverse student population.

The purpose of this research study was to examine how the perceptions of new teachers dictated their teaching styles and potential effectiveness related to understanding and dealing with the unique needs of students of color in high-needs schools. With the understanding that these perceptions play a role in the disproportionate representation of people of color in STEM majors and fields.

Understanding that perceptions play a role in overall academic success was the primary premise of this study, and that it is vital to understand the perceptions of teachers who are obligated to teach the most underrepresented students in the most underserved academic settings. This research study serves as a foundational beginning to the concept of that teacher perceptions have a direct affect on their attitudes toward teaching, communicating, and developing strategies to equip and empower students of color in STEM education can improve the experience for both students and teachers.

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CHAPTER I

INTRODUCTION

Brief Description of Background

“The United States’ failure to educate its students leaves them unprepared to compete and threatens the country’s ability to thrive in a global economy” (Hanushek, Peterson, & Woessmann, 2012, p. v). Dire warnings of this magnitude have plagued the U.S. educational system since the beginning of the 21st century. A 2010 report by the Council of Foreign Relations (Hanushek et al., 2012) showed that only 32% of U.S. eighth graders were proficient in mathematics, which caused the U.S. to be ranked 32nd among 49 participating international countries/jurisdictions.

While the ranking of U.S. students in comparison to other countries is problematic, the achievement gap that exists within the United States is of greater concern. Before the country can address its international education ranking, it must first address performance from within. In the 2011 Nation’s Report Card for science, the National Center for Education Statistics reported that Black and Hispanic students had the lowest average scores on the eighth-grade National Assessment of Educational Progress (NAEP) in science for 2009 and 2011 (U.S. Department of Education, 2011). Not only did they have the lowest scores; they also had the lowest participation percentages: Blacks 15% and Hispanics 21%. The Science Framework for the NAEP of 2009 and 2011 includes the content areas of physical, life, and earth sciences, and the science practices include the identification of science principles, use of science

principles, use of scientific inquiry, and use of technological design (U.S. Department of Education, 2011).

Over the past two decades there have been national, state, and local efforts to lift the American standard in education in hopes of keeping pace with other industrialized nations. One such effort was Public Law 107-110, enacted by the 107th Congress to close the achievement gap through accountability, flexibility, and choice, so that no child would be left behind. The No Child Left Behind Act of 2001 (NCLB) was proposed by President George W. Bush on January 23, 2001, passed by the U.S. Senate on June 14, 2001, and signed into law on January 8, 2002. NCLB requires public schools that receive any federal funding to administer annual statewide standardized testing to all students (NCLB, 2002). This is a sort of checks-and-balance system that is meant to ensure that all students across any one grade level take the same test under similar conditions. School-specific student performance is then used as an indicator of the job performance of that school's teachers and administrators. If a school's results are repeatedly under expectations, steps are taken to improve test performance (NCLB, 2002).

To strengthen the efforts of NCLB, Public Law 107-368, the National Science Foundation Authorization Act of 2002, was signed into law on December 19, 2002. This legislation appropriated funds from 2003 through 2007 for the National Science Foundation (NSF) to establish centers for research on mathematics and science learning and education improvement. Under this Act the Robert Noyce Scholarship Program was apportioned \$20,000,000 to fund scholarships to students in institutions of higher learning.

Students of Color and the Sciences

The U.S. population is becoming more diverse, with the U.S. Census Bureau estimating that people of color will comprise 44% of the population by 2020 (U.S. Census Bureau, n.d.). This increase in the general population includes the growing numbers of students of color in classrooms. However, there is still a serious lack of diversity in teaching, with 88-90% of classroom teachers being White (Sullivan Commission, 2004).

The Sullivan Commission on Diversity in the Healthcare Workforce reported that, while African, Hispanic, and Native Americans were approximately 25% of the U.S. population, they collectively made up less than 9% of nurses, 6% percent of physicians, and 5% of dentists. The Commission also indicated the importance of strong science preparation for any high school student who is interested in becoming a health professional (Sullivan Commission, 2004). As further support of the important roles that people of color have in the health of the nation, the Institute of Medicine (2004) advocated increasing diversity within the health professions as a way to eliminate health disparities.

The persistent lack of diversity in the biomedical and health sciences at both the academic and professional levels stems from multiple obstacles in primary, secondary, and postsecondary levels of education (Norman, Ault, Bentz, & Meskimen, 2001; Sullivan Commission, 2004). Diminished teacher expectations have been determined to be one of the major hindrances to timely and successful completion of primary and

secondary education by students of color, which by extension can have an adverse effect on students' overall scientific achievement (Sullivan Commission, 2004).

Addressing the severity of underrepresentation of people of color in health care fields, the Bureau of Health Professions reported that highest-paying careers in health care are overwhelmingly filled by Whites, while the lowest-paying positions have the highest concentrations of Blacks and Hispanics. The report indicated that underrepresentation of people of color in many biomedical/health education fields contributes to health disparities in America (U.S. Department of Health of Human Services, 2000).

Robert Noyce Teacher Scholarship Program

The Robert Noyce Teacher Scholarship Program is a loan forgiveness program for K–12 teacher preparation, funded through the NSF. Scholarships are provided to undergraduate majors in science, technology, engineering, and mathematics (STEM) to facilitate their entry into the teaching profession (Shilling, 2009). The program also provides funding to institutions of higher education to assist future STEM teachers by providing scholarships, stipends, and programmatic support for the student teacher's promise to teach in a high-needs school/district upon graduation. Scholarship and stipend recipients are required to complete 2 years of teaching in a high-needs school district as repayment for each year of support. The program seeks to increase the number of K–12 teachers with strong STEM content knowledge who teach in high-needs schools/districts.

Academic loan forgiveness programs such as the Noyce program have proven effective in placement of content-specific science and mathematics teachers in high-needs schools and districts (Liou, Kirchhoff, & Lawrenz, 2010). Published studies have examined the potential effectiveness of the Robert Noyce Teacher Scholarship Program throughout the United States. The majority of these studies addressed retention characteristics of teachers who have participated in the Noyce program (Liou, Lawrenz, Madsen, Braam, & Medhanie, 2009). Others have utilized their findings to compare the tenets of more traditional teacher preparation programs to those of alternative teacher preparation programs (Shilling, 2009; University of Minnesota, 2009a, 2009b). However, none has critically examined how institutions that were awarded Noyce grants build the necessary skill sets of their scholars to work, teach, and meet the academic needs of students in high-needs schools/districts, especially students of color. The educational trajectory of students of color, as well as cultural and environmental sensitivities, must be taken into consideration as these future teachers (most of whom are White) attempt to communicate, teach, and set examples for their students (Liou, Desjardins, & Lawrenz, 2010; Liou & Lawrenz, 2011).

According to the NSF (2012), the term *a high-needs local educational agency* is defined in § 201 of the Higher Education Act of 1965 (20 U.S.C. 1021) as a local educational agency (school district) that serves an elementary or secondary school located in an area that is characterized by at least one of the following: (a) a high percentage of individuals from families with incomes below the poverty line, (b) a high

percentage of secondary school teachers not teaching in the content area in which they were trained to teach, or (c) a high teacher turnover rate.

Teacher Preparation

The ultimate purpose of teacher preparation programs such as Noyce is to provide a path for those who are interested in becoming K–12 teachers. During this time of qualified teacher shortages and unsatisfactory student academic performance, teacher preparation programs have begun to emerge. Historically, teacher preparation was done through traditional teacher certification programs at traditional institutions of higher learning (Scott, Milam, Stuessy, Blount, & Bentz, 2006). However, in response to the growing teacher shortage, nontraditional teacher certification programs have emerged over the past decade (Liou et al., 2009; Scott et al., 2006).

Perceptions of preservice and inservice teachers with respect to race and class as they pertain to achievement expectations and relatability must be assessed during the teacher certification training process. Liou, Kirchhoff, et al. (2010) pointed out that the perceptions/biases of preservice teachers play an important role in their perceived classroom effectiveness and in decisions to continue teaching in high-needs schools. Research further suggests that increased recruitment strategies of NSF and the Noyce program will provide for more diversity in the recipient pool, as well as an increase in sample size and longitudinal data (Liou, Kirchhoff, et al., 2010; University of Minnesota, 2009a, 2009b).

In an effort to determine the most appropriate evaluation standards for teacher preparation processes, Boyd, Grossman, Lankford, Loeb, and Wyckoff (2008) outlined

five important indicators of preparation program quality: (a) program structure; (b) subject-specific preparation in reading and mathematics; (c) preparation in learning and child development; (d) preparation to teach racially, ethnically, and linguistically diverse students; and (e) characteristics of field experiences.

Research has determined that students of color, especially those in high-needs schools, require teachers with a unique skill set (Boyd et al., 2008). Across the United States, the majority of high-needs schools have larger populations of students of color, with cultural, socioeconomic, academic, and community issues that effective teachers/educators must be aware of and sensitive to (Norman et al., 2001; Sullivan Commission, 2004). Childs et al. (2011) indicated that teacher preparation programs have an “equity through admissions” responsibility, which they explained as equity for the students where their graduates will work. The Sullivan Commission (2004) also alluded to the responsibility of secondary science and mathematics teachers to capture and introduce the requirements, opportunities, and options available in postsecondary education and health-related career options. Classroom teachers are often the first to speak to students of color in real-life terms about college attendance and career selection (Liou, Desjardins, et al., 2010), especially in high-needs schools. Therefore, issues of race/ethnicity and exposure must be given special consideration.

To complicate the issue of accomplishing sustained student academic achievement and engagement, there is now great debate regarding the most effective way to prepare “highly qualified” K–12 teachers (Boyd et al., 2008). Some believe that the best way to attract strong, committed individuals is to simplify the entrance process

(Boyd et al., 2008; U.S. Department of Education, 2002). Others argue for investment in high-quality teacher training and preparation programs as the best way to serve America's K–12 students (National Commission on Teaching and America's Future [NCTAF], 2007).

However, irrespective of how well teachers are prepared to meet the challenges of in-class instruction, if they do not have the dedication or determination to stay the course, much of that preparation process is for nothing. According to a report from the Harvard University Civil Rights Project, as many as one third of teachers quit before gaining years of experience in the field and approximately 50% of the working teacher pool quits at around the 5-year mark (Horn & Kurlaender, 2006). The report emphasized that these numbers are even higher in high-needs and low-socioeconomic areas.

Problem Statement

It is unclear how the perceptions of new teachers dictate their teaching styles and their perceived effectiveness related to understanding and dealing with the unique needs of students of color in high-needs schools.

Research has examined the issues faced by many students of color in high-needs schools/districts, especially as they affect student achievement and preparedness for STEM education. Research has also examined the effectiveness of various teacher preparation programs and identified the issues that have led to high attrition rates of science and mathematics teachers in high-needs schools. However, little research has examined how the perspectives of new science and mathematics teachers affect their performance and their attitudes toward students of color in high-needs schools.

The issue of STEM teacher preparation has been examined; however, there is a need to improve understanding of (a) the commitment of teachers to teaching in high-needs schools/districts, (b) the correlation between their perceptions of their teacher preparation process and how committed new teachers are to remain in high-needs schools/districts, and (c) the comfort level of science major graduates in communicating and in meeting the academic needs of their students of color.

The focus of this doctoral research study was graduates of the Texas A&M (TAMU) aggieTEACH Robert Noyce Teacher Scholarship Program. The purpose of the study was lay a perception-based foundation for future evaluation of this and other teacher preparation programs. Although these observations may be considered anecdotal, they warrant investigation in the hope of improving not only aggieTEACH Robert Noyce Teacher Scholarship Program implementation but also the overall approach to student selection and preparation of educators who will teach in high-needs schools.

Operational Definitions

The following terms are operationally defined for application in this report.

High-needs school: An elementary, middle, or high school in which 50% or more of the enrolled students are eligible for participation in the free/reduced-price lunch program established by the Russell National School Lunch Act.

High-needs school district: According to the NSF (2012), a district that meets the following characteristics: (a) at least one school in which 50% or more of the enrolled students are eligible for participation in the free/reduced-price lunch program; (b) at least one school in which (i) more than 34% of the academic classroom teachers at the

secondary level (across all academic subjects) do not have an undergraduate degree with a major or minor in, or a graduate degree in, the academic field in which they teach the largest percentage of their classes; or (ii) more than 34% of the teachers in two of the academic departments do not have an undergraduate degree with a major or minor in, or a graduate degree in, the academic field in which they teach the largest percentage of their classes; and (c) at least one school whose teacher attrition rate has been 15% or more over the past 3 school years.

Perception: the result of perceiving, observation, a mental image; in cognitive psychology, perception involves both the physical senses (sight, smell, hearing, taste, touch, and proprioception) and the cognitive processes involved in interpreting those senses.

Students of color: Persons who do not self-identify as White (of European descent).

Research Questions

A preliminary search of the literature yielded few resources regarding the characteristics of the most successful teacher preparation programs, such as the Robert Noyce Teacher Scholarship Program, that specifically train preservice teachers who are committed to teaching in high-needs schools/districts. This paucity of research led to formulation of the primary research question for this study: “To what extent are participants and graduates of a STEM teacher preparation program prepared to meet the diverse academic needs of underserved and underrepresented students of color in high-needs academic settings?”

Three specific research questions guided the study:

1. What program characteristics of teacher preparation programs are most important in the certification of STEM teachers who are assigned to teach in high-needs schools/districts?
2. How do the perceptions of scholars of a STEM teacher preparation program affect their attitudes and perceived effectiveness in high-needs academic settings?
3. How do science major graduates of the aggieTEACH Robert Noyce Teacher Scholarship Program perceive their preparation and effectiveness in meeting the academic needs of students of color in high-needs settings?

This dissertation research study focused on exploring the relationship between personal perceptions of preparation programming, cultural competence/sensitivity curriculum during preparation programming, and in-class strategies used to meet the academic needs of students of color in science.

Overall Research Plan

This manuscript formatted dissertation consists of three studies designed to address the three research questions regarding how teacher perceptions meet the unique academic needs of students of color in high-needs secondary education settings. Each study yielded its own manuscript to address a specific research question. In combination, the three studies address the primary research question

Studies and Methods

Study 1

The first study was designed to address Research Question 1: *What program characteristics of teacher preparation programs are most important in the certification of STEM teachers who are assigned to teach in high-needs schools/districts?* The review of literature for this study identified curriculum requirements of the most effective teacher preparation programs charged with training preservice science and mathematics teachers to teach in high-needs schools. A well-defined matrix was developed to examine and compare teacher preparation programs, specifically their implementation and required curriculum, as they specifically related to preparing teachers to be assigned to high-needs schools.

The results of this study are contained in a chapter formatted as a manuscript to be submitted to the journal *Educational Research*, tentatively titled “The Makings of Successful Teachers for the High-Needs School Setting.”

Study 2

The second study was designed to address Research Question 2: *How do the perceptions of scholars of a STEM teacher preparation program affect their attitudes and perceived effectiveness in high-needs academic settings?* This quantitative analysis examined the perceptions of former scholars of the aggieTEACH Robert Noyce Teacher Scholarship Program as they pertained to the program, their preparedness to teach in high-needs settings, and their commitment to continue teaching in high-needs schools/districts after completing their obligation to the program. This was accomplished

by performing statistical analysis on responses to the aggieTEACH Noyce Scholars Self-Assessment Survey: Former Students to identify respondents' perceptions, preparation, and commitment.

Descriptive analyses were used to evaluate the perceptions of scholarship recipients related to continuing to teach in high-needs schools/districts (Boyd et al., 2008; Childs et al., 2011), as well as their perceptions about students in high-needs settings and their general impression of the aggieTEACH Robert Noyce Teacher Scholarship Program structure. This information was obtained via a Likert-type scale survey (Appendix A) administered to former aggieTEACH Robert Noyce Teacher Scholarship Program participants. The survey was disseminated via SurveyMonkey™ and data analysis was completed via the Statistical Package for the Social Sciences (SPSS) Version 18. After collection, the data were cleaned, with missing data accounted for and response rate determined. The survey was approved by the Institutional Review Board (IRB) of TAMU.

The results of this study are contained in a chapter formatted as a manuscript to be submitted to the journal *Education and Urban Society*, tentatively titled “Texas A&M aggieTEACH Robert Noyce Scholars’ Perceptions of Preparation, Teaching, and High-Needs Schools/Districts.”

Study 3

The third study was designed to address Research Question 3: *How do science major graduates of the aggieTEACH Robert Noyce Teacher Scholarship Program perceive their preparation and effectiveness in meeting the academic needs of students*

of color in high-needs settings? This study was conducted via one-on-one interviews with Noyce scholars who had majored in science to determine their comfort and confidence levels in teaching science in high-needs schools to students of color. Current statistics indicate that students of color, especially Blacks and Hispanics, suffer from a large achievement gap throughout the United States. The purpose of this study was to determine whether former science majors of the aggieTEACH Robert Noyce Teacher Program considered themselves to be prepared to communicate effectively, teach, and fulfill the unique educational requirements of students of color in high-needs schools.

A qualitative case study approach was utilized to assess the racial/cultural understanding of participating science teachers who had received scholarship funds through the aggieTEACH Robert Noyce Teacher Scholarship Program. Intrinsic analysis of the case studies was also done to provide participant-specific information as it related to involvement in the Noyce program (Creswell, 2007). Previously administered assessment tools were examined to assist in the development of a tool specific to this study.

All interviews were conducted after receiving approval from the TAMU Institutional Review Board. Interviews were conducted by one interviewer and followed the approved semistructured interview outline in order to maintain continuity of the process. To maintain the integrity of the interviews, they were recorded with agreement by the interviewees, after which each interview was transcribed and reviewed for information accuracy. Upon review of completed interviews, themes were identified to ascertain the viewpoints of inservice teachers who majored in science (Lincoln & Guba,

1985). These themes dealt with preparedness to teach, confidence to communicate, and strategies to teach and work with students of color in high-needs schools.

This qualitative research study was also designed to measure the success of the aggieTEACH Noyce Program in meeting the NSF goal of preparing content-trained teachers to teach in high-needs schools/districts as a way of preparing underserved and underrepresented students for STEM majors and careers. The descriptions consisted of *how* former scholars experienced the program and *what* they had experienced as students and were currently experiencing as teachers (Stake, 1995).

Results of this study are contained in a chapter formatted as a manuscript to be submitted to the *Journal of Negro Education*, tentatively titled “Reaching Students of Color: The Obstacles and Strategies of Science Teachers in High-Needs Schools.”

Chapter Summary

Understanding that perceptions play a large role in reality, it was the premise of the main study that it is vital to understand the perceptions of teachers who are obligated to teach the most underrepresented students in the most underserved academic settings. Understanding how the perceptions of teachers in high-needs schools/districts affect their attitudes toward teaching, communicating, and developing strategies to equip and empower students of color in STEM education can improve the experience for both students and teachers.

CHAPTER II

**MANUSCRIPT FOR STUDY 1: “THE MAKING
OF SUCCESSFUL TEACHERS FOR THE
HIGH-NEEDS SCHOOL SETTING**

Brief Description of Background

“The United States’ failure to educate its students leaves them unprepared to compete and threatens the country’s ability to thrive in a global economy” (Hanushek, Peterson, & Woessmann, 2012, p. v). Dire warnings of this magnitude have plagued the U.S. educational system since the beginning of the 21st century. A 2010 report by the Council of Foreign Relations (Hanushek et al., 2012) showed that only 32% of U.S. eighth graders were proficient in mathematics, which caused the U.S. to be ranked 32nd among 49 participating international countries/jurisdictions.

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Students of Color and the Sciences

The U.S. population is becoming more diverse, with the U.S. Census Bureau estimating that people of color will comprise 44% of the population by 2020 (U.S. Census Bureau, n.d.). This increase in the general population includes the growing numbers of students of color in classrooms. However, there is still a serious lack of diversity in teaching, with 88-90% of classroom teachers being White (Sullivan Commission, 2004).

The Sullivan Commission on Diversity in the Healthcare Workforce reported that, while African, Hispanic, and Native Americans were approximately 25% of the U.S. population, they collectively made up less than 9% of nurses, 6% percent of physicians, and 5% of dentists. The Commission also indicated the importance of strong science preparation for any high school student who is interested in becoming a health professional (Sullivan Commission, 2004). As further support of the important roles that people of color have in the health of the nation, the Institute of Medicine (2004) advocated increasing diversity within the health professions as a way to eliminate health disparities.

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Robert Noyce Teacher Scholarship Program

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percentage of secondary school teachers not teaching in the content area in which they were trained to teach, or (c) a high teacher turnover rate.

Teacher Preparation

The ultimate purpose of teacher preparation programs such as Noyce is to provide a path for those who are interested in becoming K–12 teachers. During this time of qualified teacher shortages and unsatisfactory student academic performance, teacher preparation programs have begun to emerge. Historically, teacher preparation was done through traditional teacher certification programs at traditional institutions of higher learning (Scott, Milam, Stuessy, Blount, & Bentz, 2006). However, in response to the growing teacher shortage, nontraditional teacher certification programs have emerged over the past decade (Liou et al., 2009; Scott et al., 2006).

Perceptions of preservice and inservice teachers with respect to race and class as they pertain to achievement expectations and relatability must be assessed during the teacher certification training process. Liou, Kirchhoff, et al. (2010) pointed out that the perceptions/biases of preservice teachers play an important role in their perceived classroom effectiveness and in decisions to continue teaching in high-needs schools. Research further suggests that increased recruitment strategies of NSF and the Noyce program will provide for more diversity in the recipient pool, as well as an increase in sample size and longitudinal data (Liou, Kirchhoff, et al., 2010; University of Minnesota, 2009a, 2009b).

In an effort to determine the most appropriate evaluation standards for teacher preparation processes, Boyd, Grossman, Lankford, Loeb, and Wyckoff (2008) outlined

five important indicators of preparation program quality: (a) program structure; (b) subject-specific preparation in reading and mathematics; (c) preparation in learning and child development; (d) preparation to teach racially, ethnically, and linguistically diverse students; and (e) characteristics of field experiences.

Research has determined that students of color, especially those in high-needs schools, require teachers with a unique skill set (Boyd et al., 2008). Across the United States, the majority of high-needs schools have larger populations of students of color, with cultural, socioeconomic, academic, and community issues that effective teachers/educators must be aware of and sensitive to (Norman et al., 2001; Sullivan Commission, 2004). Childs et al. (2011) indicated that teacher preparation programs have an “equity through admissions” responsibility, which they explained as equity for the students where their graduates will work. The Sullivan Commission (2004) also alluded to the responsibility of secondary science and mathematics teachers to capture and introduce the requirements, opportunities, and options available in postsecondary education and health-related career options. Classroom teachers are often the first to speak to students of color in real-life terms about college attendance and career selection (Liou, Desjardins, et al., 2010), especially in high-needs schools. Therefore, issues of race/ethnicity and exposure must be given special consideration.

To complicate the issue of accomplishing sustained student academic achievement and engagement, there is now great debate regarding the most effective way to prepare “highly qualified” K–12 teachers (Boyd et al., 2008). Some believe that the best way to attract strong, committed individuals is to simplify the entrance process

(Boyd et al., 2008; U.S. Department of Education, 2002). Others argue for investment in high-quality teacher training and preparation programs as the best way to serve America's K–12 students (National Commission on Teaching and America's Future [NCTAF], 2007).

However, irrespective of how well teachers are prepared to meet the challenges of in-class instruction, if they do not have the dedication or determination to stay the course, much of that preparation process is for nothing. According to a report from the Harvard University Civil Rights Project, as many as one third of teachers quit before gaining years of experience in the field and approximately 50% of the working teacher pool quits at around the 5-year mark (Horn & Kurlaender, 2006). The report emphasized that these numbers are even higher in high-needs and low-socioeconomic areas.

Gap in the Research

While there is a wealth of information comparing types of teacher preparation programs and addressing the nation's teacher retention woes, there is little research specifically addressing the characteristics of successful teacher preparation programs focused on educating educators for urban settings. According to Sleeter (2001) and Kirchoff and Lawrenz (2012), successful teacher preparation programs must possess three very essential pieces for their preservice students and new inservice teachers: (a) multicultural education courses, (b) a strong and lasting mentor and colleague networks, and (c) early career follow-up.

According to The Sullivan Commission (2004), at least 80% of STEM teachers in urban settings are White, while more than 80% of urban students are of color (U.S.

Department of Education, 2011). Many of these new teachers were not afforded in-depth coursework, student teaching opportunities, or mentoring in cross-cultural communication or sensitivity (Sleeter, 2001). The inability to connect with students of color, especially those in urban settings, fosters an environment of discourse and missed educational opportunities.

Another quality of successful urban teacher preparation programs is the development of sustainable peer/colleague and mentor relationships. When they have experienced a professional network prior to graduation, new inservice teachers enter their careers with a strong support system (Sleeter, 2001). This system of support is often familiar not only with the teacher in a professional sense but also in a personal sense; this level of familiarity can make it easier for the teacher to request help, information, and insight when dealing with unique in-class situations (Kanter & Konstantopoulos, 2010; Sleeter, 2001). One of the most common issues for new inservice teachers is the absence of a support network, which can contribute to feelings of dissatisfaction and regret, especially for teachers in urban and high-needs schools (Kanter & Konstantopoulos, 2010). Another positive attribute of building solid network structures prior to program completion is the ability to build new mentor and colleague networks in different professional settings after graduation (Boyd et al., 2008; Sleeter, 2001).

Many successful teacher preparation programs maintain a level of contact and system of follow-up with program graduates (Kirchhoff & Lawrenz, 2012). This process of planned follow-up is beneficial for program administrators, graduates, and current

students (Kirchhoff & Lawrenz, 2012; Sleeter, 2001). Program administrators can use follow-up as an evaluative and reporting tool for program and course improvement, as well as for continued support of graduates. Thorough evaluation programs can determine what works best for their student population and, in some cases, even the schools in which their students will eventually serve (Boyd et al., 2008; Kirchhoff & Lawrenz, 2012). As with most funded programs, the funding agency requires some form of reporting on program development, implementation, and growth. By maintaining a consistent level of tracking and follow-up, teacher preparation programs can easily and quickly provide the necessary information, while maintaining a supportive relationship with former students. Purposeful follow-up can also give former program participants the sense that program administrators care about their professional success, as they did about their academic success (Boyd et al., 2008; Kanter & Konstantopoulos, 2010; Kirchhoff & Lawrenz, 2012). Another very important aspect of program follow-up is the positive effect that it can have on current students. By sustaining a contact pool of former graduates, administrators can make programmatic changes that can benefit matriculating students and, if necessary, build strong networks for program participants (Kirchhoff & Lawrenz, 2012).

Discussion

The disproportionate representation of people of color in STEM fields has been well documented, with the need for educational improvements cited as one of the best solutions to solve the problem. However, one issue that is often overlooked or inadequately evaluated is the educational process of the teachers who are teaching or

will teach students of color. Regardless of the academic aptitude and content competence of teachers in urban or high-needs settings, if they do not possess the knowledge, skills, and abilities to communicate and to connect with their students, the teacher-student divide will continue to grow and the nation's goal of increasing the numbers of people of color in STEM fields will not be accomplished.

For this reason, the author's dissertation research looked at former students of the Texas A&M University aggieTEACH Robert Noyce Teacher Preparation Program, particularly their perspectives a year after graduating from the program, related to their preparation process and experiences for teaching in urban/high-needs schools. This research provided a unique look into the teacher preparation process and its potential in-practice effectiveness, as described by actual scholarship recipients with real-world teaching experience.

CHAPTER III

MANUSCRIPT FOR STUDY 2: “TEXAS A&M aggieTEACH ROBERT NOYCE SCHOLARS’ PERCEPTIONS OF PREPARATION, TEACHING, AND HIGH-NEEDS SCHOOLS/DISTRICTS”

Throughout the United States, increasing emphasis has been given to the recruitment of undergraduate students to major in secondary science and mathematics in educator preparation programs (Scott, Milam, Stuessy, Blount, & Bentz, 2006). In Texas, public schools lose approximately 15% of certified teachers after their second year of employment (Texas Education Agency [TEA], 2013). This loss of certified teachers, particularly in secondary mathematics and science classrooms, requires school districts to decrease course offerings, increase classroom size, or employ uncertified teachers. In 2010, the Texas Education Agency (TEA; 2012) reported the percentages of uncertified middle school and high school mathematics teachers as 7.2% and 10.9%, respectively; these percentages increased in public school settings to 8.3% and 13.2%, respectively. These percentages of employed uncertified mathematics and science teachers illustrate the need for increased recruitment and certification of teachers, especially in secondary science, technology, engineering, or mathematics (STEM) education.

Data on the outcomes of these programs are mixed. Some sources indicate that the most successful teacher preparation programs provide students with a solid network of mentors and colleagues prior to graduation (Kirchhoff & Lawrenz, 2012). Other research indicates that providing courses and activities in cross-cultural or multicultural

competence is essential for preservice teachers who plan to teach in urban and high-needs schools/districts (Boyd, Grossman, Lanford, Loeb, & Wychoff, 2008; Sleeter, 2001). However, little comparative research has been done on programs that provide both aspects in their programs versus programs that do not do so (Boyd et al., 2008; Kirchoff & Lawrenz, 2012). While evaluation efforts are continually under way for these types of programs, the focus has been on outcomes. Little attention has been paid to program participants' experiences and perceptions of the programs and their components, including how these aspects might influence objective measures of program success. While program indicators of success are available, there is a paucity of information regarding program participants' perceptions of their experiences in such programs.

The purpose of this study is to assess the experiences and perceptions of former participants (i.e., alumni) of a STEM education training program. This study focused on the Robert Noyce Teacher Scholarship Program, as a sample program. The research questions were (a) How do graduates of the Texas A&M University (TAMU) aggieTEACH Robert Noyce Teacher Scholarship Program perceive the program? and (b) Do these graduates feel prepared to teach and communicate with students in high-needs schools/districts? The study focused the alumni's intent to teach in Title I school districts, their perceptions of the program, and their perceived level of preparedness to teach urban/high-needs students and analyzed data from a survey (Appendix A).

TAMU's aggieTEACH Robert Noyce Teacher Scholarship Program

The TAMU Robert Noyce Scholarship Program is a project of The Center for Mathematics and Science Education (CMSE), in collaboration with the aggieTEACH Program in the College of Science. It has recruited and trained STEM undergraduates for secondary mathematics and science educator certification since 2001 (Scott et al., 2006). The NSF award period for this research covered the 2009–2013 program, which provided 47 one-year scholarships of \$10,000 (\$5,000 per semester) to undergraduate students majoring in STEM areas and pursuing teaching careers in secondary education (Grades 8–12). The Colleges of Science and Education at TAMU coordinate initiatives to address the need for more and better-prepared science and mathematics teachers via the aggieTEACH Program. In general, these initiatives promote the recruitment of STEM undergraduates by offering unique field experiences, internship opportunities, innovative coursework, and financial assistance. The program, along with these existing initiatives, offers financial support and activities to ensure sustained enrollment and increased diversity of candidates who seek teacher certification. In addition, the program seeks to ensure a high quality education for much-needed teachers in the concentrations of science and mathematics.

The research question that guided this study was, *How do the perceptions of scholars of a STEM teacher preparation program affect their attitudes and perceived effectiveness in high-needs academic settings?*

Methods

While the overall larger study used a mixed-methods approach, this paper focuses on a subset of the larger evaluation. Specifically, a cross-sectional research design was used to assess participants' perceptions of factors related to their program experience. Approval was obtained for the study protocol from the TAMU Internal Review Board.

Participants

Three former aggieTEACH Robert Noyce scholars who had completed 1 year of teaching participated in the evaluation; one had majored in physics and two had majored in biology ($n = 2$). All were 2009-2010 Noyce scholars and received funding in spring 2010 for the 2009-2010 academic year. Inclusionary criteria for the questionnaire part of the evaluation research study were (a) Robert Noyce Teacher Scholarship recipient, (b) TAMU graduate in good standing per university requirements, (c) enrolled in the College of Science, (d) science or mathematics major, (e) science or mathematics teacher in a high-needs school, and (f) at least 1 year of teaching experience in science or mathematics. All three teachers who met the inclusionary criteria completed the questionnaire. There was low variability across participant characteristics.

Measure/Instrument

A web-based survey was developed specifically to measure the success of this particular program. The instrument items were adapted and developed from evaluation questionnaires used by Noyce scholar programs at similar universities (University of Minnesota, 2009a, 2009b). CMSE staff and undergraduate assistants offered feedback

about the clarity of the survey items and survey completion times. After final edits of survey items, the survey was administered electronically. Item response choices were placed on a Likert-type scale. The domains of the survey items used to conduct the assessment are shown in Table 1.

Table 1

Question Domains of the Survey

Question areas	Question topics
Perceptions of program	Impact of Noyce scholarship on education Perceptions of the program
Teaching preparation during first year	Perceptions of preparation to teach
Perceptions of preparation	Perceptions of preparation to teach
Commitment to teaching	Commitment to the field of teaching Commitment to teaching in high-needs schools/districts

Procedures

The process of data collection for this study began with development of a survey that was administered to former (alumni) scholars. The survey was extensively reviewed by members of the administrative staff of the TAMU CMSE. Emails were sent to qualified scholarship recipients alerting them that the link to an Internet-based survey would be disseminated in the coming weeks and requesting that respond to the survey. Within 2 weeks another email was sent, with a SurveyMonkey™ link, instructions for

responding to the survey, and a requested completion date. All survey responses were confidential in compliance with IRB protocols.

Data Analysis

Data analysis was performed using Statistical Package for Social Sciences (SPSS) Version 18. With such a small sample size, analysis was limited to descriptions, similar to the protocol used by Liou, Kirchoff, and Lawrenz (2010), who conducted a similar study in which they illustrated relationships between major and length of time to receive the Robert Noyce scholarship with perceived persistence in teaching.

Results

Description of Participants

Of the three participants, one was male and two were female. One was a physics major and two were biology majors. All three received the Noyce Teacher Scholarship for their final two semesters, or senior year, at TAMU. All self-identified as White.

Participants' Perceptions of the Program

The participants answered a series of questions designed to assess their perceptions of the helpfulness of the Noyce scholarship funds and the overall preparation tools of the Noyce program. As described in Table 2, two of the three respondents indicated that, even without the Noyce scholarship, they would have been able to attend college; however, all strongly agreed that the scholarship funds had significantly reduced their educational expenses. One agreed that the scholarship had influenced the decision to pursue teacher certification.

Table 2

Impact of Receiving the aggieTEACH Robert Noyce Teacher Preparation Scholarship

Item	SA	A	N	D	SD
I would not have been able to attend college without the scholarship	0	0	1	2	0
My educational expenses were significantly reduced	3	0	0	0	0
The scholarship influenced me to pursue teaching certification	0	1	0	2	0

Note. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree.

Participants’ Perceptions of Preparation

The participants, all former students of the aggieTEACH Noyce scholarship program, were asked about their interactions with and perception of the scholarship coordinator during their time in the program. They indicated overall positive perceptions regard the concern, communication, and response time of the coordinator (Table 3).

Participant responses varied regarding instructing students in high-needs schools/districts, with one indicating extensive experience (EE), one indicating some time (ST) spent in addressing this issue, and one indicating no exposure (None), as shown in Table 4. Table 4 illustrates participants’ answers regarding their exposure to teachers with experience in high-needs education settings, as well as class management and how to function effectively in high-needs schools. To each of these items the responses ranged from *extensive experience* (EE) to *touched on it briefly* (TB).

Table 3

Perceptions of aggieTEACH Robert Noyce Teacher Preparation Program Coordinator

Item	SA	A	N	D	SD
The coordinator cared about my becoming a certified teacher.	2	1	0	0	0
The coordinator answered questions in a timely manner	2	1	0	0	0
The coordinator continues to communicate with me (email, phone, mail)	0	3	0	0	0

Note. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree.

Table 4

Perceptions Regarding Student Teaching Experience in High-Needs Schools/Districts

Item	EE	Exp	ST	TB	None
Instructing students in a high-needs school/district	1	0	1	0	1
Observing experienced teachers in a high-needs school/district	2	0	1	0	0
Practicing classroom management	0	1	1	1	0
Specific information about how to work in high-needs schools	1	0	0	2	0

Note. EE = Extensive Experience, Exp = Explored in Some Depth, ST = Spent Time Discussing or Doing, TB = Touched on Briefly, No = Not Addressed.

Another important aspect of this research was to determine how survey participants perceived their preparation in relating to students from other ethnic and cultural backgrounds in the classroom setting. Participants were asked whether the program provided strategies for teaching students from diverse racial and ethnic backgrounds and interaction opportunities with students in high-needs schools/districts. These former students provided a varied range of answers (Table 5) to these items, which could be indicative of their involvement in various program activities or difference instruction approaches by their professors.

Table 5

Perceptions of Student Teaching Experience With Students From Diverse Populations

Item	EE	Exp	ST	TB	None
Implementing specific strategies for teaching students from diverse racial and ethnic backgrounds	0	1	1	0	1
Interacting with students in a high-needs school/district	0	1	1	1	0
Interaction with children of cultures different from my own	0	1	1	0	1
Opportunities to observe in high-needs schools/districts (not student teaching)	1	0	2	0	0

Note. EE = Extensive Experience, Exp = Explored in Some Depth, ST = Spent Time Discussing or Doing, TB = Touched on Briefly, No = Not Addressed.

Participants' Perceptions of Teaching Preparation During First Year

These participating former Noyce scholars were asked about their preparation to teach students of low socioeconomic status in high-needs schools. Table 6 indicates that two of the three participants were prepared to teach these students in this type of setting.

Table 6

Perceptions of Teaching Students With Low Socioeconomic Backgrounds

Item	VP	P	PPB	NP	N/A
Teaching low socioeconomic students	1	2	0	0	0

Note. VP = *Very Prepared*, P = *Prepared*, PP = *Poorly Prepared*, NP = *Not Prepared*, N/A = *Not Applicable*.

Participants' Commitment to Teaching

The participating former students of the aggieTEACH Noyce program were asked about their commitment to and feelings about teaching in high-needs schools or districts. Table 7 displays participants' responses to these items. The responses indicated not only a commitment to teaching but also a commitment to continue teaching in high-needs schools.

Responses to items about participants' commitment to students, especially in high-needs schools/districts, are shown in Table 8. The participants indicated that they could make a positive difference in the lives of their students and that they could reach unmotivated students. They agreed or strongly agreed that students in high-needs

Table 7

Perceptions of Commitment to a Teaching Career

Item	SA	A	N	D	SD
I make a difference in the lives of students	0	3	0	0	0
I do not see myself as a classroom teacher.	0	0	0	2	1
It is an honor to teach.	2	1	0	0	0]
I do not see teaching as a viable career.	0	0	0	2	1
Teaching is my first choice of careers.	3	0	0	0	0
Teaching is a noble profession.	3	0	0	0	0
I would not be teaching if I did not get summer and winter vacations	0	0	1	1	1

Note. SA = *Strongly Agree*, A = *Agree*, N = *Neutral*, D = *Disagree*, SD = *Strongly Disagree*.

schools/districts require more motivation than their counterparts in more affluent school/districts.

Discussion

Because the primary goal of the NSF Robert Noyce Teacher Scholarship Program is to place content-trained teachers in high-needs schools/districts, it was important to understand the perceptions held by graduates from the TAMU aggieTEACH Robert Noyce Teacher Scholarship Program regarding their preparedness to teach and interact with students in high-needs settings.

The program had an overall positive effect on its first cohort of scholars, while making teaching in high-needs schools/districts a viable option. The financial and

Table 8

Perceptions of Commitment to Teach in High-Needs Schools/Districts

Item	SA	A	N	D	SD
I do not believe all students can learn.	0	0	1	0	2
How I teach affects the lives of my students.	1	2	0	0	0
I am committed to teaching in a high-needs school/district.	2	1	0	0	0
Students in a high-needs school/district require more motivation to learn than students who are not in a high-needs school/district.	1	2	0	0	0
If I try really hard, I can make a positive impact on even the most challenging or unmotivated students.	1	2	0	0	0
I believe I will teach in a high-needs school/district for the full term of my Noyce Scholar commitment.	2	1	0	0	0
If some students are not performing at the minimum standard, I feel I should change my approach to teaching.	0	3	0	0	0
I believe I make a positive impact in the lives of my students.	2	1	0	0	0
The Noyce Scholars program fostered my commitment to teaching in a high-needs school/district.	1	2	0	0	0
Parents of students in a high-needs school/district care about education.	0	1	0	2	0
I believe it is the student's responsibility to motivate himself/herself to achieve academic success.	0	1	2	0	0
I would rather teach in a school/district that is not classified as having high needs.	0	0	2	0	1

Note. SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree.

coordinator support provided by the program eased economic stressors often related to attending college, also giving participants academic and accountability support. The reported positive reactions from former students could be considered indicators of the importance of coordinator communication and accessibility for program scholars during their matriculation process.

The participants' perceptions of their exposure to high-needs educational environments and students were mixed. These varied responses could stem either from a lack of meaningful exposure to these indices or absence of the program plainly outlining the purpose of certain experiences or activities. Regardless of the reason for this mix of perceived exposure, the program should address the issue of preservice exposure to high-need settings and students so scholars become clearly exposed to this concern and their perceptions of exposure are more consistent.

Another important aspect of teaching in high-needs schools/districts is that more than 50% of students in these settings are considered to be of low socioeconomic status (U.S. Department of Education, 2011). As with ethnic and cultural differences, differences in economic positioning can have an effect on in-class interactions (Sullivan Commission, 2004; U.S. Department of Education, 2011).

Similar to these former scholars' perceptions about exposure to high-needs school/district settings, they had mixed perceptions about exposure or discussion relative to interacting with students from different cultural or ethnic backgrounds. This perceived lack of intentional exposure could be just as harmful as no actual exposure at all, because the importance of cultural understanding, sensitivity, and competence might be

missed. This is especially true as statistics indicate that as many as 70% of urban and high-needs schools/districts educate students of color (U.S. Department of Education, 2011). On a more consistent note, participants in this study perceived themselves to be very prepared or prepared to teach students of low socioeconomic status. With that said, it would be interesting to explore this perception more fully, since there was such a mix of perceptions about their exposure to students in high-needs classrooms.

Although the participants expressed mixed perceptions about their experiential learning opportunities in high-needs school/district settings, they all expressed a commitment to students in high-needs schools/districts. These former Noyce scholars had very mixed perceptions of exposure and interaction that the program had provided them with students in high-needs schools/districts, as well as with students from different cultural backgrounds. These perceptions could indicate that program administrators/coordinators should make a concerted effort to increase scholars' exposure to a diverse population of students prior to completion of the teacher preparation program. The importance of preservice exposure to high-needs academic environments and students has been well documented (Kirchhoff & Lawrenz, 2012; Sleeter, 2001). This could be supported by these participants' perceptions that students in high-needs schools/districts need more motivation than their more affluent counterparts. Perhaps even more interesting was that two of the three participants agreed that parents with children in high-needs schools/districts do not care about education; this supports research that suggests that many teachers in high-needs settings do not

expect to get academic support from the homes of their students (Kanter & Konstantopoulos, 2010; Sullivan Commission, 2004).

Although the results of this study varied depending on the area of perception that the participants were addressing, an area of strong agreement was their commitment and viewpoints about the field of teaching. The fact that these participants conveyed that teaching is not only a noble profession and a viable career choice indicates a very hopeful and determined attitude about their commitment to the profession. Whether this commitment existed prior to their acceptance in the aggieTEACH Robert Noyce Teacher Scholarship Program or the program helped to strengthen their commitment, it can only be hoped that they stay dedicated to the cause of educating students in high-needs schools/districts.

The failings of the U.S. educational system are well documented, especially related to disparities in the number of students of color that consider science or mathematics majors or go on to work in related fields. Several programs have been implemented in attempts to make STEM majors and fields more diverse and representative of the U.S. population. However, little attention has been paid to the preparation of well-rounded, culturally sensitive, and content-competent teachers in the classrooms of high-needs schools/districts. While placing content-competent teachers in high-needs classrooms, the ability of these teaching professionals to relate to, communicate with, and be culturally sensitive to all students, especially students of color, is important for their success in STEM courses.

Limitations of the Study

Acknowledged limitations of the study include the small sample size and the analysis of only one Noyce program. However, this research serves as a beginning step toward more expansive, detailed research. Research that uses more descriptive statistics, cluster analysis (Liou, Kirchhoff, et al., 2010), and a thorough exploration of inferences is the hope for the future.

Future Research

As mentioned in the Limitations section, continued surveying of TAMU Noyce recipients, as well as inclusion of other Noyce programs in the nation, and even comparisons with other teacher preparation programs, would provide insight into the potential effectiveness, efficacy, and sustainability of these programs and possibly increase overall academic success at the primary and secondary levels of science and mathematics education.

Another aspect of future research might be to analyze how the psychological perceptions of preservice teachers affect the success of both teachers and students. It would be fruitful to explore how preconceived consciousness directs teaching styles, attitudes, and commitment. As outlined in this study, two of the three participants did not agree that parents of students in high-need academic settings care about education. This perception suggest that (a) TAMU Noyce scholars need more interaction with parents and guardians of students in high-needs settings, (b) the teachers' perception that these parents do not care could undergird conventional thinking of new teachers in high-needs schools so that these teachers do not expect needed support from the homes of their

students, and (c) this perception could be one of the reasons many teachers with 5 years or less of inservice teaching experience transfer out of high-needs schools/districts or leave education altogether (Liou & Lawrenz, 2011).

CHAPTER IV

MANUSCRIPT FOR STUDY 3: “REACHING STUDENTS OF COLOR: THE OBSTACLES AND STRATEGIES OF SCIENCE TEACHERS IN HIGH-NEEDS SCHOOLS”

Texas A&M University aggieTEACH Robert

Noyce Teacher Scholarship Program

The Colleges of Science and Education at Texas A&M University (TAMU) coordinate initiatives to promote recruitment of science, technology, engineering, and mathematics (STEM) undergraduates by offering unique field experiences, internship opportunities, innovative coursework, and financial assistance. The Noyce Teacher Scholarship Program is one such program offering financial support and activities to ensure sustained enrollment and increased diversity of candidates seeking teacher certification. Activities conducted by the Noyce program include developing informative seminar series and providing opportunities for outreach and interaction with low socioeconomic youth. These Noyce scholars are also able to participate in academic advising, mentoring, and high-quality professional development opportunities as preservice and newly certified teachers.

Program Description

The aggieTEACH Robert Noyce Teacher Scholarship Program is overseen by the CMSE, which is housed in the College of Science at TAMU, a large Tier 1 university in east central Texas. This Noyce scholarship program has been funded by the National Science Foundation (NSF) since 2009 and accepts 5 to 8 students per semester.

Student advising and program development occurs in the Center for Math and Science Education (CMSE) office. Selected Noyce scholars attend science and mathematics classes within the College of Science, majoring in biology, chemistry, nutritional sciences, physics, or mathematics. All education pedagogy and methods classes attended by Noyce scholars occur in the College of Education and Human Development.

By the end of the program (June 2013), 47 one-year scholarships at \$10,000 per year (\$5,000 per semester) will have been given to undergraduate students majoring in science, technology, engineering, or mathematics (STEM) topics and pursuing teaching careers in secondary education (Grades 8–12). The Colleges of Science and Education at TAMU coordinate initiatives to address the need for more and better-prepared science and mathematics teachers, via the aggieTEACH Program. In general, these initiatives promote recruitment of STEM undergraduates by offering unique field experiences, internship opportunities, innovative coursework, and financial assistance. The Noyce Teacher Scholarship Program, along with these existing initiatives, offers financial support and activities to ensure sustained enrollment and increased diversity of candidates seeking teacher certification. In addition, the program ensures high-quality education for much-needed teachers in the concentrations of science and mathematics who will maintain a steadfast commitment to teaching in high-needs schools/districts upon graduation and certification.

Study Design

Research Question

The research question that guided this study was, *How do science major graduates of the aggieTEACH Robert Noyce Teacher Scholarship Program perceive their preparation and effectiveness in meeting the academic needs of students of color in high-needs settings?*

Purpose

The purpose of this study was to explore the perceptions held by and strategies used by graduates of the TAMU aggieTEACH Robert Noyce Teacher Preparation Program related to teaching in high-needs schools, specifically teaching science to students of color.

Inclusionary Criteria

Inclusionary criteria for this qualitative case study, a part of a larger evaluation research study, were as follows: (a) Robert Noyce Teacher Scholarship recipient, (b) TAMU graduate in good standing per university requirements, (c) enrolled in the College of Science, (d) science or mathematics major, (e) science or mathematics teacher in a high-needs school, and (f) at least 1 year of teaching experience in science or mathematics. At the time of this study, six graduates of the aggieTEACH Noyce Program were identified as meeting the first four criteria. After initial contact, one former student was disqualified due to failure to be certified and therefore not teaching. Of the remaining five qualified prospective participants, three responded immediately

and agreed to participate in the study. Two follow-up emails were sent to the other two candidates, to no avail; after the third attempt, they were eliminated from the study.

The three program graduates who had agreed to participate were contacted to reconfirm their willingness to participate, and all confirmed their intent. All three were given a general background to the research purpose, process, and consent requirements. Each received another confirmation email, along with an attached copy of the TAMU Institutional Review Board (IRB) informed consent form (Appendix B). They were asked to review, complete, and return the signed consent form, after which time interviews would be scheduled at their convenience. Two of the three probable participants returned consent forms and interviews were quickly scheduled. However, after two contacts, the third person decided not to continue in the process and did not sign the consent form.

Both consenting participants were interviewed using an IRB-approved semistructured format (Appendix C). The interviewer did not deviate from interview questions in order to maintain interview continuity. The interviews were transcribed and reviewed for accuracy, with all identifying information removed; case-based themes were then identified from each interview.

Methodology

Because of the limited number of prospective participants in this study, a case study approach was deemed best to accomplish the study purpose. As outlined by Creswell (2007), case study research explores issues/questions within a bounded system. This methodological approach is what Stake (1995) identified as an intrinsic case study.

The intrinsic case study focuses on a single case of interest that presents an unusual or unique situation. For the purposes of this study, the aggieTEACH Robert Noyce Teacher Scholarship Program was considered to be the case. In this research process, cases (interviews with qualified participants) were used to perform a within-site examination of the TAMU aggieTEACH Robert Noyce Teacher Preparation Program system. Themes were developed and analyzed by reviewing each interview as a separate case, after which a cross-case analysis was conducted to identify similarities and differences between cases (Lincoln & Guba, 1985).

Case Studies

The semistructured interview consisted of 16 questions, the majority of which solicited open-ended answers with explanations. Case study themes from each interview are outlined below, with quotes from each participant.

Participant 1 was a White male, 21-25 years of age, with 3 years of teaching experience in a high-needs school. Eight major themes emerged in relation to science education and students of color in this case study.

When asked about the capabilities of students of color as they relate to science, two themes emerged. First, equal educational opportunities are important for all students, especially students of color. “Given the same opportunities, given the same backgrounds, I don’t see why students of color would be any less prone to doing well in a science classroom than White [students].” Second, several factors (home, socioeconomic status, background) contribute to the overall success of students of color

in science. “[Many] factors go into it. I realize that. I realize that home life and socioeconomic status and all that can factor in.”

When asked whether there are challenges in encouraging and empowering students of color in science, he cited a widespread lack of appreciation and understanding of the value of science concepts. He provided the following example as it related to athletes.

I think a lot of them don’t see the need for it [science], especially when they are good athletes. But, I guess, the same could be said for students that are White that are good athletes as well. I just feel like it’s more prevalent in students of color.

When asked to describe various strategies utilized to overcome the challenges of empowering and encouraging students of color in his science classes, the participant indicated the importance of developing relationships with the student’s home base.

I feel like home relationships, in terms of either mother or grandmother or father, whoever it is that it might be, students of color might have a little bit of a closer relationship with those guardians or parents in the home.

The fifth theme, using concepts that students can relate to, arose from responses to the strategies questions. However, the participant expressed concern about not wanting to “come off stereotypical” in discussing the strategy of using concepts and language to which students of color could relate in the classroom.

The participant also confirmed communication challenges in dealing with students of color, to which the theme of issues of cultural communication was

developed. These communication challenges were primarily attribute to language and English Language Learner status. He also articulated the need to understand what students were trying to say before displaying/providing a reaction.

I really have to listen to what they're saying so I know what they're meaning and making sure that I understand what it is . . . what kind of interaction we're having, and don't jump to conclusions if I don't know exactly what's going on.

In response to the question of what should be done to increase the number of students of color in science and health-related majors and careers, the participant's responses led to the theme of experiential learning.

Giving them more opportunities to see if they enjoy that type of career in a high school setting, or even in a junior high or middle school setting, but increasing the opportunities . . . if you do something that's good for one population, that's more than likely going to be good for everyone.

In addition, the participant 1 conveyed the importance of encouragement through the necessity of motivation throughout the educational process and how this is especially true for students of color.

Participant 2 was a White male, 21-25 years of age, with 1 year of teaching experience in a high-needs school. From this interview seven major themes regarding students of color and science education were extrapolated.

This participant affirmed that students of color were capable in science, supported by his observation that students of color performed as well as and even above

their White counterparts. However, he noted a significant gap in achievement, which he did not equate to the measure of capacity, rather to lack of effort.

[Students of color] are not putting in the same amount of effort. But at least I've noticed that, even though I believe and know that they have the same capabilities, I often do not see that translated to scores and paper grades.

The participant also acknowledged many of challenges in the encouragement and empowerment of students of color in science. When asked whether there are challenges in encouraging and empowering students of color in science, the participant highlighted two points. First was curriculum selection and bias.

One of the main challenges I face when I'm teaching and planning a lesson in that it just seems that all the curriculum is focused toward educating White kids . . . just kind of very White culture biased. . . . Questions have cultural bias, but also even just teaching them about all the great scientists of the world, or the majority of them, are predominately White men, and so it's hard to get them excited about things when it feels like another European history lesson.

The second issue was that of motivation.

It is a big challenge to get students of color motivated the same way as their White counterparts, because a lot of White kids already have a natural intrinsic motivation to learn because it's like a history of their people. But it's much harder to get a student of color as motivated naturally, and I think that a big part of that is that there's not a lot of heroes in science that are of color themselves.

The inquiry method of instruction was utilized by this participant to overcome classroom challenges of motivation, bias, encouragement, and empowerment of students of color in science. This approach allows him to incorporate the concept of “let’s go tinker with such and such.” He said that this sparks students’ curiosity and increases their desire to learn for themselves. In addition he attempts to make cultural connections with students.

[I use] silly rap videos on YouTube and not even necessarily rap, but just kind of modern day pop and hip-hop . . . kind of incorporate cultural references and tying science into their culture even if it’s kind of incongruous, it still can happen. I’ve seen it still work and make it lighthearted and funny rather than monotonous.

With regard to communication challenges and educating students of color, the participant related more to student age than to race/ethnicity.

In response to the question of what should be done to increase the number of students of color in science and health-related majors and careers, the themes of heroes and goal-setting were identified.

“Having forerunners and kind of like heroes for kids to look up to is really important . . . there being examples of people of color who have made strides in science and medicine. Also, I think that being more intentional about . . . incorporating and making it more of a multicultural diverse thing. . . . Giving kids heroes to look up to I think is really important for any field.

Understanding the importance and repercussions of short- and long-term goals was expressed. This participant had encountered several students who “default to

working 40 hours a week while trying to do high school” because of the short-term payoff “but then the long-term consequences of them not finishing high school or finishing high school poorly, I don’t think they see that.” He stated that it is imperative to show students heroes of color the importance of long-term goal setting in education.

Perception of Program

When asked about the TAMU aggieTEACH Noyce program, both participants stated that they would definitely recommend the program to others who are interested in teaching STEM-related courses. However, they both stressed the importance that prospective scholars entering the program have the desire to teach in high-needs schools, while understanding how vital they are to the educational process. Participant 1 indicated that the TAMU program had stayed in contact with him. He indicated that the follow-up had been useful in increasing his professional development, pedagogy, and resource accumulation.

Discussion/Assertions

Upon reviewing participant interview transcripts and identifying emerging themes, it appeared that communication and cross-cultural dynamics were of major concern in the classrooms of these science teachers. Although the teachers felt prepared to teach in schools classified as high-need, they were not as comfortable or confident about teaching students of ethnic or cultural backgrounds different from theirs. They both indicated an understanding that, by providing content and “heroes” to whom students of color could relate, the students often appreciated the content more and did better in the classroom.

Concern was expressed about sounding or appearing biased through their professional lens regarding how to reach and assist students of color. This apprehension could be a cause of concern, as it could hinder efforts to make adjustments when necessary for students of color in high-needs academic settings. This fear of sounding biased would be best addressed before these professionals become inservice teachers, as they struggle during their first years in the classroom. As stated by Bentley (2013), previous research has found that teacher preparation programs requiring in-depth discussion and exposure to multicultural issues and sensitivity have shown higher levels of effective teaching by teachers and increased learning by students.

Participant 2 highlighted the importance of being self-aware and understanding that science education has not been taught from a lens of diversity, which affects the self-efficacy and interest levels of students of color. This level of awareness seems to be unique and it would be interesting to interview other teachers in high-needs settings to get their perspectives on cultural issues and diversity in curriculum. In addition, this participant reported utilizing the inquiry method of instruction with the aim of getting students involved in their learning and knowledge acquisition. The perspectives of his students prior to taking his class and upon completion could be an interesting research endeavor, in an attempt to ascertain the effectiveness of a culturally diverse inquiry approach as it pertains specifically to students of color.

Participant 1 spoke about the importance of equity as it relates to the education of all students, along with maintaining contact with students' parents/guardians. He implied that, if given the same opportunities, students of color could perform on par with their

White counterparts. Opening the lines of communication with parents/guardians, even for disciplinary reasons, ensures greater understanding and cooperation between the academic setting and home. The participant stated that he had found this approach to be helpful for all parties (students, parents/guardians, and teachers), particularly in providing multiple levels of support to the student.

However, both participants expressed concern about how students of color view the importance and value of science education. They attributed a lack of understanding to the lag of achievement often seen in students of color in high-needs schools. Familial issues of finance were cited as a primary reasons that some students of color did not fully comprehend how short-term goals can have lasting effects on life, academics, and economics. The fact that many families in high-needs districts are from low socioeconomic positions can lead some students in these areas to feel responsible or to be forced to work outside the home to assist in meeting familial financial obligations. In the juggle of academics and financial, familial, and social obligations, academics often takes the position of least importance.

The overall message from these interviews is that issues of communication, interaction, and culture play defining roles in the educational process, especially for students of color. These issues, along with others, must be addressed if the U.S. education system is to provide equality in the educational process and prepare a diverse population of citizens to serve in scientific and biomedical health fields.

Limitations of the Study

The limitations of this study include the sample size and homogeneity of participants. These interviews are recognized to be a beginning phase of what should be an ongoing body of research and dialog. More in-depth interviews could record facial expressions and body language, which could offer additional insight into the interviewees' comfort level(s) in discussing issues of race, ethnicity, and culture. Such indices as racial and gender concordance could be considered limitations of this study, as the interviewer was a Black female and both interviewees were White males.

Future Research

Future research in this area should include attention to the psychometrics of the instrument to ensure validity and reliability of study results. Interviews could be evaluated from a psychological standpoint for a better understanding of the subconscious perceptions of participants. These types of interviews should be conducted with preservice teachers to examine their preconceived notions and implicit biases about teaching students of color in high-needs schools/settings. To help build a solid body of research about the perceptions of educators assigned to teach some of the most vulnerable, underrepresented, and disadvantaged students in the nation, cross-sectional evaluations of teachers from various teacher preparation programs and cultural backgrounds could produce stronger inferential findings.

CHAPTER V

DISCUSSION OF THE DISSERTATION PROJECT

It is undeniable obvious that the United States has fallen behind many other industrialized countries in terms of STEM education of its citizenry. The nation faces a daunting task (Hanushek et al., 2012; NCLB, 2002; U.S. Department of Education, 2011). Many explanations, rationales, and solutions have been offered in the pursuit of resolution, along with a litany of research into the topic (National Science Foundation Authorization Act of 2002; NCLB, 2002; Sullivan Commission, 2004). Such research has ranged from examination and comparison of teacher preparation programs, to examination of issues that affect teacher retention in the field and in certain schools and districts, to the characteristics that most affect students' academic performance and achievement (Liou et al., 2009; Norman et al., 2001; Sullivan Commission, 2004). However, there has not been as much research looking into the preconceived notions or perceptions of before they enter the classroom or early into their career; especially of those who have committed to working in high-need schools/districts and with a diverse student population.

The primary purpose of this research study was to examine how the perceptions of new teachers dictated their teaching styles and their potential effectiveness related to understanding and dealing with the unique needs of students of color in high-needs schools. The studies that were developed for this research were not done to identify opinions from a psychological standpoint, but rather to examine the importance of teacher perception on the techniques, tactics, and strategies implemented in an attempt to

improve the academic outcomes of students of color in high-needs schools, as they pertain to STEM education and career pursuits.

Three individual manuscripts were developed out of the research completed for this study, to be submitted as articles to peer-reviewed journals. The three articles entailed separate aspects of the research agenda in an effort to address the primary research question from different approaches. The first manuscript was developed through a review of the literature in an effort to determine whether there was a gap in the research regarding the preparation of teachers dedicated or obligated to teaching in high-needs schools/districts. The second manuscript was developed through a quantitative approach, with the purpose of examining the perceptions of new inservice science or mathematics teachers who had graduated from a loan forgiveness program that obligated them to teach in a high-needs school/district for a specified length of time. The third manuscript was developed through a qualitative approach that utilized case studies, developed through an interview process, to examine the perspectives and strategies of inservice science teachers in high-needs schools as they related to instruction of students of color.

Manuscript 1

The lack of diversity in STEM education and careers throughout the United States has been acknowledged for years and various efforts have been made to address this crisis (Sullivan Commission, 2004; U.S. Census Bureau, n.d.). These efforts have ranged from development of programs with a specific focus on bringing science and mathematics into high-needs schools/districts where the underserved and

underrepresented are most highly concentrated to preparing content-trained teachers to enter the often highly neglected classrooms of these high-needs academic settings (National Science Foundation Authorization Act of 2002; Scott et al., 2006; Shilling, 2009). Unfortunately, there has not been marked improvement or an increase in the number of students of color from these high-needs settings pursuing STEM majors or entering related fields.

Upon completion of an in-depth review of the literature and development of a matrix, a gap in the research was noted in the specific qualities of the most successful teacher preparation programs as they relate to curriculum and the perceptions of accepted students (Kanter & Konstantopoulos, 2010; Kirchhoff & Lawrenz, 2012; Sleeter, 2001). Three qualities of the most successful programs were identified (a) detailed and extensive course work dealing with cultural sensitivity and cross-cultural competency, (b) a strong network of support by peers and mentors, and (c) mentor or coordinator/program follow-up with recently certified teachers.

With these issues in mind and for the purpose of this research, the TAMU aggieTEACH Robert Noyce Teacher Preparation Program was selected as a convenience sample. To provide a precise perspective, only former students of the program who were current science or mathematics teachers were selected to participate in the quantitative and qualitative aspects of the research study. The research was delimited to examination of this teacher preparation process, its perceived effectiveness in the preparation of teachers obligated to teach in high-needs schools/districts, and the perceptions of

program scholars as they pertain to the program and teaching students of color in high-needs academic settings.

Manuscript 2

In light of the fact that the primary goal of the NSF Robert Noyce Teacher Scholarship Program is to place content-trained teachers in high-needs schools/districts (NSF, 2012), it was important to understand the perceptions of program graduates related to their preparedness to teach and interact with students in high-needs science and mathematics settings.

This study showed that the program was viewed positively by its first cohort of scholars, while making teaching in high-need schools/districts a viable option. The financial and coordinator support provided by the program eased the economic, academic, and accountability stressors that are often related to attending college. These positive reactions from former students could be considered indicators of the importance of the development of a professional network of support during the preservice phase of teacher preparation (Boyd et al., 2008; Sleeter, 2001).

With regard to program-required exposure to high-needs environments and students in these settings, participant perceptions were mixed. These varied responses were attributed generally to a lack of meaningful exposure to students in these environments or the lack of program-required curriculum that plainly explained the reason and importance of student saturation through certain experiences and activities (Kanter & Konstantopoulos, 2010; Kirchoff & Lawrenz, 2012).

These former scholars also expressed mixed perceptions about their exposure to interacting with students from other cultural or ethnic backgrounds. This lack of perceived exposure was somewhat troubling for two very important reasons:

(a) Multicultural competency/sensitivity is one of the most important aspects of top-rated teacher preparation programs (Kirchhoff & Lawrenz, 2012; Sleeter, 2001), and

(b) statistics indicate that as many as 80% of urban and high-needs schools/districts educate students of color (Boyd et al., 2008; Sullivan Commission, 2004). Because the Noyce program specifically seeks to place teachers in high-needs schools/districts (NSF, 2012), this could be viewed as a shortcoming of the TAMU aggieTEACH Program.

Two of the most promising aspects of the quantitative study were the participants' attitudes about their career choice and their commitment to remain in a high-needs academic setting after completion of their program obligation. The fact that the participants perceived teaching as a noble and viable career choice indicates a level of hope and a determined attitude to stay committed to the profession of education.

Manuscript 3

The case studies (Creswell, 2007; Stake, 1995) that were part of this qualitative research provided insight into the teaching strategies of aggieTEACH Noyce Program graduates who were teaching science in high-needs schools, as well as some of their perceptions related to their students of color. From each semistructured interview, the domains of communication and the dynamics of race and culture emerged (Lincoln & Guba, 1985). Although study participants felt prepared to teach in schools classified as high-need, they were not as comfortable or confident about teaching and relating to

students of different ethnic or cultural backgrounds. They understood the importance of providing students of color “heroes” and examples to which they could relate and they readily admitted that their departmentally accepted curriculum did not include these features.

Study participants expressed concern about sounding biased in their assessments of teaching relating to dealing with students of color. This might be attributed to educational differences exist between high-needs and non high-needs schools; attention should be given to the differing academic needs of students of color versus those of their White counterparts. By continuing to sweep such issues under the proverbial rug, the reality that teacher placement, curricular adjustments, and textbook changes must be made in order to make the educational process in the United States more inclusive will continue to be overlooked.

One of the most troubling aspects of this qualitative study was the perception by participants that students of color did not view science education as important and that these students did not understand how short-term goals (work, economics) could adversely affect long-term goals (academic pursuits, career choices). Although no direct relationship was stated by participants, these perceptions could be associated to the inequity in the U.S. educational system, as well as the apprehension/fear by teachers and educators to address or even understand the “real-life” issues of academics, family, and social that many of today’s students must face.

The failings of the U.S. educational system have been well documented, especially as they pertain to disparities in the number of students of color who consider

science or mathematics as viable majors or careers, compared to the number of their White counterparts. In various attempts to address these disparities, numerous programs have been implemented to make STEM majors and fields more diverse and representative of the U.S. population. Because little sustainable success can be celebrated, the purpose of this research was to start a dialog and lay a foundation regarding the importance of preparing well-rounded, culturally sensitive, and content-competent teachers for classrooms in high-needs schools/districts. The results of the study confirm the importance of teachers' perceptions regarding how they teach, communicate, and encourage students of color in high-need schools/districts.

The results of this research study securely support that the emphasis expressed by a teacher preparation program plays a major role in the perceptions and degree of dedication of their graduates regarding teaching in high-needs settings and in instruction of students of color. When in-depth exposure and experiential learning opportunities are not provided, the least-prepared teaching professionals are often overwhelmed and work day to day without guidance. Furthermore, when the nuances of cultural, racial, and ethnic differences are not addressed, teaching professionals may not recognize how their own preconceived biases can affect how they relate to, interact with, and guide their teaching strategies.

The findings of this study definitely highlight the critical need for programs with the express purpose of preparing teachers to serve in high-needs schools/districts to implement deliberate cross-cultural and sensitivity education and training. Perhaps just as important would be a psychological assessment of future educators related to their

ability to confront and overcome personal biases and subconscious prejudices. The inability to relate to and understand how to reach their students, especially those of color, will work against closing the achievement gap and the educational divide that is currently a part of the “melting pot” that is the United States of America.

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APPENDIX A

aggieTEACH NOYCE FORMER STUDENT SURVEY



**Noyce Scholars Self –Assessment Survey:
Former Students**

Date of Birth: _____ TAMU Major: _____

Circle the number of **semesters** you **received** Noyce Scholarship funds: 1 2 3 4

Circle the semester you **began** receiving Noyce Scholarship funds: S-2009 F-2009 S-2010 F-2010

NOTE: S = Spring and F = Fall

S-2011 F-2011 S-2012 F-2012

Impact of Receiving Noyce Scholarship						
<i>To what extent do you agree with the following statements about being awarded a Noyce Scholarship:</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Applicable
I would not have been able to attend college without the Scholarship.						
My education expenses were significantly reduced.						
The Noyce Scholarship influenced me to pursue teacher certification.						
Without the Scholarship I would have delayed completing the teacher certification process.						
Without the Noyce Scholarship, it would have been difficult to pay for my education.						
I would not have considered teaching in a high needs school/district without having received the Noyce Scholarship.						
I would not have considered being a teacher without the Noyce Scholarship.						
I would not have completed the teacher certification program without the Noyce Scholarship.						
Had I not been awarded the Noyce scholarship, I would have continued my major in a STEM field.						
Without having received the Noyce Scholarship, I would have had to work while completing my degree requirements.						
Without having received the Noyce Scholarship, it would have taken me longer to complete my degree requirements.						
Being awarded the Noyce Scholarship helped me to maintain enrollment as a						

Version 9/26/12

full-time student.						
I maintained my GPR because of the availability of the Noyce Scholarship.						
The Noyce Scholarship decreased the amount of loans I needed to fund my education.						
It was an honor to receive the Noyce Scholarship.						

What proportion of your tuition and fees was covered by your Scholarship?

- 0% 51% - 75% I don't know
 1% - 25% 76% - 99%
 26% - 50% 100%

Perceptions of aggieTEACH Noyce Scholars Program						
<i>To what extent do you agree with the following statements about Noyce Scholar coordination:</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Applicable
The Noyce Scholar coordinator cared about my becoming a certified teacher.						
The Noyce Scholar coordinator answered my questions in a timely manner.						
The Noyce Scholar coordinator was available for questions regarding my degree plan (or course sequence).						
My relationship with the Noyce Scholar coordinator encouraged me to continue as a Noyce Scholar.						
The Noyce Scholar coordinator provided information to help me meet my academic goals (e.g. tutoring services, career counseling services).						
The Noyce Scholar coordinator continues to communicate with me (eg. via email, telephone, or postal mail communications).						
The Noyce Scholar coordinator provides me with opportunities to connect with current Noyce Scholars in aggieTEACH .						
The Noyce Scholar coordinator provides me with opportunities to connect with other former Noyce Scholars (ie.						



Noyce Scholars Self -Assessment Survey: Former Students

graduates of aggieTEACH).						
The Noyce Scholar coordinator assisted me in finding a position in a high-needs district/school.						
The Noyce Scholar coordinator provided information about how to identify high-need districts/schools.						
I felt comfortable contacting the Noyce Scholar coordinator about identifying high - need districts/schools.						

Did you participate in one or more Noyce Scholars seminars? Yes No

If no, please explain why:

Based on your current teaching experiences, what seminar topics would you suggest for future Noyce Scholar seminars?

If you answered yes, please respond to the following questions:

<i>To what extent do you agree with the following statements about Noyce Scholar Seminars:</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Noyce Scholars seminars were informative.					
Noyce Scholars seminars encouraged me to continue as a Noyce Scholar.					
Noyce Scholars seminars presented information about teaching in a high needs district/school.					
Noyce Scholars seminars were a good use of my time.					
Noyce Scholars seminars allowed me to interact with former Noyce Scholars.					
Noyce Scholars seminars allowed me to interact with current teachers.					
Noyce Scholars seminars allowed me to					

cultivate professional relationships with current teachers.					
Noyce Scholars seminars allowed me to interact with students of high-need schools/districts.					
Noyce Scholars seminars allowed me to cultivate professional relationships with school administrators.					
Noyce Scholars seminars allowed me to cultivate professional relationships with district administrators.					
Noyce scholar seminar topics were applicable to my interests.					
Knowledgeable professionals presented Noyce scholar seminar topics.					
Noyce scholar seminars were held at times in which I was able to attend.					
Noyce Scholar seminars were held in convenient locations on campus.					
Information presented during Noyce Scholar seminars contradicted information presented in my teacher certification courses.					

Based on your current teaching experiences, what seminar topics would you suggest for future Noyce Scholar Seminars?

Did you participate in one or more Noyce Scholars service activities? Yes No
If no, please explain why you did not participate in Noyce Scholar service activities:

If you answered yes, please respond to the following questions:

<i>To what extent do you agree with the following statements about Noyce Scholar service activities (e.g. tutoring, judging science/math fairs):</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Noyce Scholars service activities provided experiences that were useful in high needs districts/classrooms.					

Noyce Scholars service activities encouraged me to continue as a Noyce Scholar.					
Noyce Scholars service activities were compatible with my interests.					
Noyce Scholars service activities allowed interaction with former Noyce Scholars.					
Noyce Scholars service activities allowed interaction with current teachers.					
Noyce Scholars service activities provided opportunities to cultivate professional relationships with current teachers.					
Noyce Scholar service activities allow me to interact with English Language Learners (ELL).					
Noyce Scholars service activities provided opportunities to interact with students in high-need schools/districts.					
Noyce Scholars service activities provided opportunities to cultivate professional relationships with school administrators.					
Noyce Scholars service activities provided opportunities to cultivate professional relationships with district administrators.					
Noyce Scholars service activities allowed me to interact with students of diverse backgrounds.					
Noyce Scholars service activities allowed me to experience different cultures.					
Noyce Scholars service activities provided opportunities to interact with parents of students of high-need schools/districts.					
Noyce Scholars service activities allowed me to visit low-socio-economic status communities.					
Noyce Scholar service activities provided opportunities to interact with community leaders.					
Noyce Scholar service activities allowed me to participate in community-based programs.					

Perceptions of Preparation to Teach												
To what extent did each program provide the following:	Via Noyce Scholar Experiences					Via Teacher Certification Courses						
	Extensive Experience	Explored in some depth	Spent time discussing or doing	Touched on it briefly	None	Not Sure	Extensive Experience	Explored in some depth	Spent time discussing or doing	Touched on it briefly	None	Not Sure
Attend field experiences.												
Instruct students of a high-needs district/school.												
Observe experienced teachers.												
Practice classroom management.												
Complete cultural awareness projects.												
Motivate students to learn.												
Complete community outreach projects.												
Complete self - reflection activities.												
Develop differentiated instructional lesson plans.												
Explore and identify personal cultural background (i.e. who you are and your beliefs).												
Develop engaging classroom assignments.												
Complete projects requiring contributions by several group members.												
Explore cultural beliefs other than my own.												
Considering the effects of education on democracy.												
Implement specific strategies for teaching students identified with learning disabilities.												
Implement specific strategies for teaching students from diverse racial and ethnic backgrounds.												
Study stages of child development.												
Considering the effects of education on social justice.												
Study stages of child learning.												

Interact with students of a high-needs district/school.														
Reflect on personal beliefs about others.														
Implement specific strategies for teaching English Language Learners (ELL).														
Reflect on personal culture (i.e. who you are and your belief systems).														

<i>To what extent did each program provide the following:</i>	Via Noyce Scholar Experiences					Via Teacher Certification Courses							
	A great deal of emphasis	Significant emphasis	Moderate emphasis	Minimal emphasis	No emphasis	Not Applicable	A great deal of emphasis	Significant emphasis	Moderate emphasis	Minimal emphasis	No emphasis	Not Applicable	
National Science Education Standards													
Biology Texas Essential Knowledge and Skills (TEKS)													
Physics Texas Essential Knowledge and Skills (TEKS)													
Chemistry Texas Essential Knowledge and Skills (TEKS)													
Integrated Physics and Chemistry Texas Essential Knowledge and Skills (TEKS)													
College and Career Readiness Standards (CCRS) for Science													
National Council of Teachers of Mathematics Focus in High School Mathematics: Reasoning and Sense Making													
Algebra I Texas Essential Knowledge and Skills (TEKS)													
Geometry Texas Essential Knowledge and Skills (TEKS)													
Math Models Texas Essential Knowledge and Skills (TEKS)													
Algebra II Texas Essential Knowledge and Skills (TEKS)													
Pre-calculus Texas Essential Knowledge and Skills (TEKS)													

Biology					
Chemistry					
Earth and Space Science (ESS)					
Integrated Physics and Chemistry (IPC)					
Middle school Math					
Middle school Science					
Physics					
Algebra I					
Geometry					
Algebra II					
Math Models					
Pre-calculus					
Calculus					
Math TAKS Prep Courses					
Advanced Placement (AP) students					
Gifted and Talented (GT) students					
Low Socio Economic status students					
English Language Learners (ELL)					
Special Education students					
International Baccalaureate (IB) students					

Perceptions of Commitment to Teaching					
<i>Now that you have completed your first year of teaching, to what extent do you agree with the following statements about teaching:</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I make a difference in the lives of students.					
I do not see myself as a classroom teacher.					
It is an honor to teach.					
I do not see teaching as a viable career.					
Teaching is my first choice of careers.					
Teaching is a noble profession.					
I would not be teaching if I did not get summer and winter vacations.					
I do not believe all students can learn.					
<i>Now that you have completed your first year of teaching, to what extent do you agree with the following statements about teaching in a high needs classroom/district:</i>	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I am committed to teaching in a high needs district/school.					
Students in a high-need district/school require more motivation to learn than students who					

are not in a high-need distric/school.					
If I try really hard, I can make a positive impact on even the most challenging or un-motivated students.					
I believe I will teach in a high needs district/school for the full term of my Noyce Scholar commitment.					
If some students are not performing at the minimum standard, I feel I should change my approach to teaching.					
I believe I make a positive impact in the lives of my students.					
The Noyce Scholars program fostered my commitment to teaching in a high needs district/school.					
I believe I will teach in a high needs district/school beyond the full term of my Noyce Scholar commitment.					
Parents of students in a high-needs district/school care about education.					
I believe it is the student's responsibility to motivate himself/herself to achieve academic success.					
I would rather teach in a non- high-needs district/school.					

<i>Please indicate your agreement with the following statements.</i>	Yes	No	Does Not Apply
I am a member of the National Science Teachers Association (NSTA).			
I am a member of the National Council for Teachers of Mathematics (NCTM).			
I am currently enrolled in a university/college education program.			
I am enrolled in a Masters program.			
I attend state conferences related to my teaching field.			
I attend workshops related to my teaching field, outside of school/district- required workshops.			
I attend national conferences related to my teaching field.			



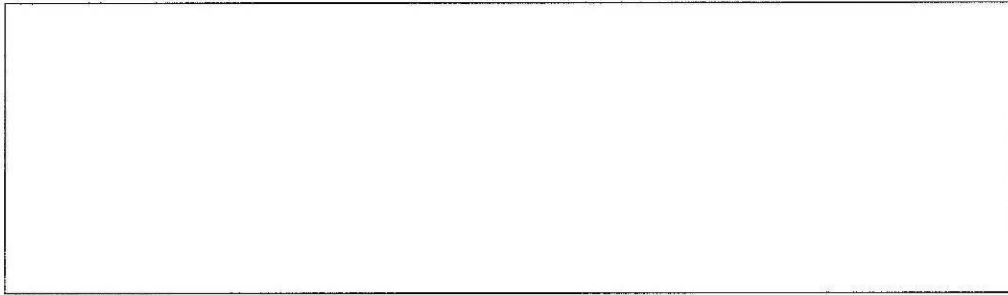
**Noyce Scholars Self –Assessment Survey:
Former Students**

Please provide any suggestions for improving your experience in the aggieTEACH Noyce Scholars program.

Please provide any suggestions for improving how you were prepared to teach in a high needs district/school.

Please describe any unique opportunities or responsibilities you experienced as an aggieTEACH Noyce Scholar.

Describe the requirements you were expected to fulfill upon completion of teacher certification requirements and the aggieTEACH Noyce Scholars program.



APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

DIVISION OF RESEARCH

Office of Research Compliance and Biosafety



APPROVAL DATE: 05/03/2013
MEMORANDUM
TO: Jeffrey Guidry
TAMU - College Of Education - Health And Kinesiology
FROM: Dr. James Fluckey
Chair
Institutional Review Board
SUBJECT: Submission Response for Initial Review Submission Form Approval

Protocol Number: IRB2013-0186
Title: The Underrepresentation of Students of Color in Biomedical and Health Education Programs and Careers: The STEM Teacher Preparation Factor
Review Type: Expedite
Approved: 05/03/2013
Continuing Review Due: 04/01/2014
Expiration Date: 05/01/2014
Review Categories and Regulatory Determinations: Category 6: Collection of data from voice, video, digital, or image recordings made for research purposes
Category 7: Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies
Document of Consent: Written consent in accordance with 45 CF 46.116/ 21 CFR 50.27

This research project has been approved. As principal investigator, you assume the following responsibilities

1. **Continuing Review:** The protocol must be renewed by the expiration date in order to continue with the research project. A Continuing Review application along with required documents must be submitted by the continuing review deadline. Failure to do so may result in processing delays, study termination, and/or loss of funding.
2. **Completion Report:** Upon completion of the research project (including data analysis and final written papers), a Completion Report must be submitted to the IRB.
3. **Unanticipated Problems and Adverse Events:** Unanticipated problems and adverse events must be reported to the IRB immediately.
4. **Reports of Potential Non-compliance:** Potential non-compliance, including deviations from protocol and violations, must be reported to the IRB office immediately.
5. **Amendments:** Changes to the protocol must be requested by submitting an Amendment to the IRB for review. The Amendment must be approved by the IRB before being implemented.

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1186 TAMU
College Station, TX 77843-1186

Tel. 979.458.1467 Fax. 979.862.3176
<http://rcb.tamu.edu>

6. **Consent Forms:** When using a consent form or information sheet, you must use the IRB stamped approved version. Please log into iRIS to download your stamped approved version of the consenting instruments. If you are unable to locate the stamped version in iRIS, please contact the office.
7. **Audit:** Your protocol may be subject to audit by the Human Subjects Post Approval Monitor. During the life of the study please review and document study progress using the PI self-assessment found on the RCB website as a method of preparation for the potential audit. Investigators are responsible for maintaining complete and accurate study records and making them available for inspection. Investigators are encouraged to request a pre-initiation site visit with the Post Approval Monitor. These visits are designed to help ensure that all necessary documents are approved and in order prior to initiating the study and to help investigators maintain compliance.
8. **Recruitment:** All approved recruitment materials will be stamped electronically by the HSPP staff and available for download from iRIS. These IRB-stamped approved documents from iRIS must be used for recruitment. For materials that are distributed to potential participants electronically and for which you can only feasibly use the approved text rather than the stamped document, the study's IRB Protocol number, approval date, and expiration dates must be included in the following format: TAMU IRB#20XX-XXXX Approved: XX/XX/XXXX Expiration Date: XX/XX/XXXX.

The Office of Research Compliance and Biosafety is conducting a brief survey for the purpose of programmatic enhancements. Click here to take survey or copy and paste in a browser
https://tamu.qualtrics.com/SE/?SID=SV_1CgOkLNU45QebyT

This electronic document provides notification of the review results by the Institutional Review Board.

APPENDIX C

INTERVIEW PROTOCOL FOR STUDY 2

OPENING THE PIPELINE FOR STEM HEALTH EDUCATION: PERCEPTIONS OF STEM TEACHER PREPARATORY PROGRAM PARTICIPANTS

Script for Semistructured Interview With Participants

1. Introduce myself
2. Explain the goals and aims of the study, and what I hope to gain from this research study
3. Explain the interview protocol
4. Give Consent
5. Demographics
6. Begin Interview
 - a. Please tell me a little about yourself
7. Can you tell me what led to your decision to apply for the Noyce Scholarship?
8. Do/did you feel prepared to teach students of color (SoC) in high need schools?
 - a. Please explain your answer.
9. Do you currently teach in what is considered a high need school?
10. Do you feel SoC are as capable as their White counterparts in science?
 - a. Please explain your answer.
11. Do you feel there are challenges in encouraging and empowering SoC in the sciences?
 - a. Please explain your answer.
12. Can you describe various strategies you utilize to overcome these challenges in your science class(es)?
13. Do you feel that there is a challenge in communicating with SoC?
 - a. If so, do you feel that this challenge exists with all students?
 - b. Please explain.
14. What do you think should be done to increase the numbers of SoC pursuing biomedical/health related majors and careers?
15. After teaching science in a high-need school, would you recommend the Noyce Scholarship to others interested in teaching?
 - a. Please explain your answer.
16. Do you have any additional comments?