Effects of teacher efficacy, certification route, content hours, experiences and class size on student achievement

Robina Salgado
Texas A & M – Kingsville

Marie-Anne Mundy
Texas A & M – Kingsville

Lori Kupczynski
University of St. Augustine for Health Sciences

Linda Challoo
Texas A & M - Kingsville

ABSTRACT

The purpose of this study was to determine the effects of teacher efficacy, the type of certification route taken by individuals, the number of content hours taken in the sciences, field-based experience and class size on middle school student achievement as measured by the 8th grade STAAR in a region located in South Texas. This data provides knowledge into the effect different teacher training methods on secondary school science teacher efficacy in Texas and how that impacts student achievement. Additionally, the results of this study determined if traditional and alternative certification programs are equally effective in properly preparing science teachers for the classroom.

Keywords: Efficacy, field-based experience, content hours, teacher training, science, alternative certification

INTRODUCTION

Teacher training programs have the capability to positively affect teacher attitudes around science content and science teaching (Bhattacharyya, Volk, & Lumpe, 2009). Therefore, teacher certification routes are integral systems, which can shape the attitudes and beliefs of teachers (Ucar, 2012). In 2001, Skamp and Muellar reported that teacher beliefs over what effective science teaching was began even before they begin teaching in the classroom and are primarily shaped by undergraduate-level sciences and science methods classes which were required for a Bachelor of Science degree.

PURPOSE

Currently a problem exists where highly qualified science, technology, engineering and math (STEM) teachers are in limited supply; as a result, certified teachers without STEM qualifications have been placed in the classroom to teach science.

The focus of this research was to determine how factors such as teacher efficacy, certification route taken by individuals, completed number of content hours taken in the sciences, week of field-based experience, and class size on middle school student achievement as measured by the 8th grade STAAR.

THEORETICAL FRAMEWORK

Teacher certification programs are the means in which teachers are trained. These programs exist to meet the demands NCLB created for schools to be staffed with highly qualified teachers in every classroom (US Department of Education, 2012). The primary goal of many teacher education programs is to develop an effective teacher by raising teacher self-efficacy in order to develop highly effective teachers through courses which equip teachers with adequate skills to work in a classroom (Yuruk, 2011).

The main theoretical framework for teacher efficacy lies in the social cognition research by Albert Bandura. Bandura created a theory called social learning. In this theory he developed the position that beliefs are personally associated with behavior (Hashmi and Shaikh, 2011). Bandura (1977) stated that self-efficacy is an individual's ability to develop the required actions to manage problematic situations as well as their beliefs about their ability to problem solve effectively. It is believed that teacher self-efficacy can influence student achievement and an individual's beliefs over their teaching and instructional execution (Skaalvik and Skaalvik, 2007).

REVIEW OF LITERATURE

Becoming a Classroom Teacher in Texas

In order to become a certified teacher in Texas several general requirements must be met. Teaching requirements are outlined by the Texas Educational Agency (TEA). Approved educator preparatory programs are offered through colleges/universities, community colleges, regional service centers, school districts and other private entities (2015).

Certification Types

Every year thousands of teachers pass through certification programs and are placed in the classrooms of our nation's schools. Recently, a great deal of academic and political attention has focused on creating, hiring and maintaining teachers who are highly qualified and effective, while also filling drastic teacher shortages in the sciences and math. In order to remedy teacher shortages, alternative pathways have been created to increase both the quality and the quantity of teachers (Heiling et. al., 2011).

Traditional Certification

The traditional certification (TC) route involves attending university and completing a teacher education program prior to becoming certified and then teaching full time. This process includes a period of time where teachers undergo some form of student teaching. When all coursework, student teaching and examination requirements have been completed individuals may apply for standard certification (2015). This route usually requires four or more years to complete.

Alternative Certification

The National Center for Alternative Certification (2010) explains alternative certification (AC) is a state defined route in which persons already in possession of a bachelor's degree can become certified to teach without having to re-enroll in college and complete requirements from a campus based teacher education program. In the typical alternative route teachers experience 4 to 8 weeks of preparation before they begin teaching and continue teacher training as they progress through the first year as a teacher (Johnson et al., 2005). Alternative certification programs were created to alleviate the shortages of teachers and to fast track individuals into the classroom (Schibner and Heinen, 2009).

No Child Left Behind and the Every Student Succeeds Act

In 2017-2018 the Every Student Succeeds Act (ESSA) will replace NCLBs law of highly qualified teachers with effective teachers (Connally, 2016). NCLB prohibited teachers on provisional and emergency certification from being considered highly qualified and under ESSA states will be allowed to decide if these certifications will belong under the heading of alternative certification (Ravitch, 2015).

ESSA also allows states to use funding to reform teacher and school leader certification systems, improve equitable access to effective teachers and leaders for all students and develop ways to effectively recruit and retain teachers (Hiller and Hatalsky, 2015). ESSA allows states to use up to two percent of their title II funds to devise "teacher preparation academies" that operate outside of state regulated alternative certification programs and colleges of education (Connally, 2016). These "teacher preparation academies" would gain state authorization if participants receive significant training under an effective teacher and demonstrate their teacher effectiveness and ability to raise student achievement prior to graduation (Connally, 2016).

History of Teacher Efficacy

Focus was brought to teacher efficacy in the 1970s by studies conducted by Albert Bandura. The construct of self-efficacy is based on the Social Learning Theory (Bandura, 1977) also named Social Cognitive Theory in 1986. Bandura (1977) referred to teacher efficacy as an individual's confidence in their own ability create a learning environment, which fosters student engagement and learning. Teacher efficacy is considered a key motivational belief influencing a teacher's professional behaviors and student learning (Klassen et al., 2011). Self-efficacy evolves from the self-concept, which can be defined as the sum of an individual's perception of themselves (Cayci, 2011). Each person has a perception of their essence, in other words, the positive and negative perception that one has developed of their own skills and other characteristics (Cacyi, 2011).

Teacher Efficacy Scales

Over the years many scales have been developed to measure teacher efficacy and define its relationship to other education factors. Bandura (1977) believed that an individual's efficacy beliefs were subject dependent. A teacher may feel more or less competent based on the subject matter being taught or the student being dealt with.

Teacher efficacy scales have grown over time and have become more complex. Riggs and Enoch (1990) developed the first science teacher specific efficacy scale. Riggs and Enoch's Science Teacher Efficacy Belief Instrument (STEBI) consists of two dimensions: personal science teaching efficacy (PSTE), the teacher's beliefs of their own ability to be an effective teacher and science teaching outcome expectancy (STOE), the teacher's belief over whether a student can learn if effective teaching takes place (Riggs and Enoch, 1990).

The survey measures an individual's sense of self-efficacy. The 25 question STEBI was the tool used to gather self-efficacy data in the study. The STEBI was developed as a tool for investigating school teachers' beliefs toward science teaching and learning (Riggs and Enochs, 1990). The STEBI uses a Likert scale format. The published Cronbach Alpha for the PSTE subscale was 0.89 and for STOE it was 0.76 (Yuruk, 2011).

The Importance of Science Proficiency

With the mandate of No Child Left Behind (NCLB) states were forced to begin measuring the progress of their students in the sciences beginning in 2007. The hope is to increase student proficiency in the sciences through increased accountability. Yet still after years of focused standards-based reform, little progress has been seen in science education through the United States (Duschl, et al, 2007).

Expectations of what it means to be competent in doing and understanding science have also changed in the last decade. Beyond skillful performance and recall of factual knowledge, students need to be able to process the science concepts they are learning at a high level, which includes making real world connections and drawing conclusions

(Duschl, et al, 2007). When students are able to process science concepts at high levels they can push their thinking further, ask deeper questions and feel prepared when their knowledge is challenged (Duschl, et al, 2007).

Creating students who are proficient in science is important in creating citizens that have the ability to make sound judgments. Understanding what it takes to learn and teach science is very different today than in years past (2007). Effective teaching and content knowledge play an important role in whether or not students achieve proficiency in the sciences.

Teacher Education Programs and Science Teaching

An interaction was seen between teacher efficacy and student success, this interaction suggests that teachers of high performing students grow in efficacy and that students taught by teachers who have high efficacy are more successful (Rimm-Kaufman and Sawyer, 2004). Teacher preparation programs should take time to shape the efficacy of their teacher candidates.

The goal of many teacher education programs is to develop an effective teacher (Yuruk, 2011). Teacher education program should focus on raising teacher self-efficacy in order to develop highly effective teachers. Skamp and Muellar (2001) noted that teachers derive their beliefs about good science teaching during the time spent in undergraduate science classes. One way to enhance science teaching efficacy is to supply these teachers in training with stronger content backgrounds (Yuruk, 2011). By focusing on standard-based goals and preparing teachers in both content and pedagogy, trained teachers will have higher efficacy in teaching science (Lumpe et al., 2012).

Individuals who feel negative and unprepared to teach science have the capability to transfer those negative beliefs on to their students (Milner et al., 2011). Teacher training programs have the capability to positively affect teacher attitudes toward science (Bhattacharyya et al., 2009). Therefore, teacher education programs are able to play an important part in creating teachers who have positive attitudes and beliefs about teaching. Teacher education programs currently focus on science content and pedagogy, but also need to take time to develop teacher attitudes about science teaching so they enter into the teaching world with positive views of science (Ucar, 2012)..

Teacher Efficacy and Student Success

In science teaching, self-efficacy is an individual's belief in their own ability to effectively teach the sciences as well as the belief that students can learn science given factors external to the teacher (Ramey-Gassert et al., 1996). Every aspect of teaching, including instructional methods, course content and assessments is influenced by a teacher's attitudes and belief in their own ability to positively impact student achievement. (Oztas and Dilmac, 2009, Keys and Bryan, 2001). Prospective teachers have reported that field based experiences in teaching situations assist in furnishing them professionally and eliminating some worries regarding the classroom experience (Kaskaya et al., 2011).

Of all the factors which exist that can affect students' academic performance, teachers have the most impact on their achievement (Parsley and Corcoran, 2003). Teachers with elevated levels of efficacy are not deterred by their students' backgrounds, refrain from negative beliefs which could interfere with their students' academic potential and do not allow social economic status to impact a students ability to learn (Parsley and Corcoran, 2003).

Class Size and Educational Impact

The reason some states are pushing for smaller class sizes is because it is believed to increase student achievement, increase time on task, and smaller classes allow teachers to better tailor their instructions to the students in the class (Schanzenbach, 2014). Some research argues that the number of students in a class only matter for teachers with low efficacy because teachers who exhibit high efficacy are able to manage larger classroom situations, but evidence shows the opposite is true (Schanzenbach, 2014).

The available evidence on how teaching is affected by small and large classes, especially on student outcomes at the secondary level is lacking, more research in this field is essential (Blatchford et al., 2007). Observations of class size at the elementary level serve as the standard for class size studies. A study by Dee and West (2011) evaluated class size effects by altering class sizes experienced by students in different courses. The study did find that urban schools with "smaller class sizes in eighth grade had a positive impact on test scores and measures of student engagement" (Dee and West, 2011, p. 24).

Although high school students serve at 30% of enrolled students, no high-quality study exists providing data at this level, proving this population is shockingly ignored. (Chingos,2013). In this respect the Tennessee's Student Achievement Ratio experiment is also an outlier, as three additional studies did not find larger class-size effects for disadvantaged students (Cho, Glewwe, and Whitler, 2012). The existing evidence also offers little guidance on how size classes affect education. Data from Connecticut, Minnesota, and Texas indicate that most classes in the U.S. enroll between roughly 15 and 30 students (Chingos, 2013). According to TEA (2014) this region located in South Texas number of students per teacher is 15.8 while the state number is 15.4.

Student Achievement Data

Estimating the effect of teacher's efficacy on student achievement requires students test score data. In the Spring of 2012, the State of Texas Assessments of Academic Readiness (STAAR) replaced the Texas Assessment of Knowledge and Skills (TAKS). The purpose of the standardized test is to assess student achievement and knowledge learned at each grade level. The majority of the new STAAR assessments will test students over readiness standards, which were studied that year, as opposed to testing content studied over multiple years (TEA, 2010). Tests are given to all registered students and provide an assessment of student learning.

METHODS

Population

Middle school science teachers from a region located in South Texas, served as the population for this study. Table 1 includes the student demographics for students in this South Texas region. The data was collected from 8th grade science STAAR from the year

2014-2015 and teachers participated in the survey in the Fall of 2015.
"as indicated in Table 1 (Appendix)".

Table 2 includes the teacher demographics for the teachers in this South Texas region.
"as indicated in Table 2 (Appendix)".

Instrumentation

This study utilized the Science Teaching Efficacy Belief Instrument. This was a 25-item efficacy scale made up of two subscales, Personal Science Teaching Efficacy Belief (PSTE) and Science Teaching Outcome Expectancy (STOE) (Bayraktar, 2011). A five point Likert type scale was used for each item. High scores indicate a stronger sense of self-efficacy and lower scores indicate little or no sense of self-efficacy

Additionally, the study used the STAAR as a measurement of student achievement.

Reliability and Validity

Reliability coefficients for PSTE and STOE were calculated as .92 and .74 (Riggs and Enoch, 1990). The internal consistency of responses were 0.86 (Riggs and Enoch, 1990).

Reliability for STAAR science test is calculated at .91 (TEA, 2014). The criterion validity for STAAR and the ACT where STAAR satisfactory academic performance is 22 and ACT advanced academic performance is 26 is 0.66 (TEA, 2012).

DATA ANALYSIS

Descriptive Statistics

Table 3 includes the demographics for the participants in the study.
"as indicated in Table 3 (Appendix)".

Inferential Statistics

The ANOVA indicated no significant difference between route of certification on student achievement, F (1, 18) = 1.78, p = .20, partial η^2 = .09.

No significant difference was seen between number of science content hours on student achievement, F (1.18) = .36, p = .56, partial η^2 =.02.

There was no significant interaction among route of certification and number of content hours in the sciences on student achievement, F (1, 18) = .36, p = .85, η^2 = .002.

Figure 1 represents how number of science content hours in alternative certification and number of science content hours in traditional certification affect student achievement as measured by the 8th grade science STAAR. The ANOVA indicated no significant difference between route of certification on student achievement, F (1, 18) = 3.65, p=.07, partial η^2=.17.
"as indicated in *Figure* 1 (Appendix)".

No significant difference was seen between weeks of field based teaching on student achievement, F(1, 18) = 1.25, p=.28, partial η^2=.07.

There was no significant interaction among route of certification and weeks of field based teaching on student achievement, F (1, 18) = 1.48, p = .24, η^2= .08.

Figure 2 represents how weeks of field based teaching in alternative certification and weeks of field based teaching in traditional certification affect student achievement as measured by the 8th grade science STAAR. A multivariate analysis of variance was conducted to assess if there were differences between alternative certification and traditional certification on a linear combination of personal science teacher efficacy, science teaching outcome expectancy and total science teacher efficacy as measured by the Science Teacher Efficacy Belief Instrument. No significant differences were found, Wilk's Λ = .93, F (1, 25) = .62, p = .61, partial η^2 = .08.
"as indicated in *Figure* 2 (Appendix)".
Table 4 represents the means and standard deviation on the dependent variable based on certification route.
"as indicated in Table 4 (Appendix)".

A multivariate analysis of variance was conducted to assess if there were differences between 0-24 and 25+ science content hours on a linear combination of personal science teacher efficacy, science teaching outcome expectancy and total science teacher efficacy as measured by the Science Teacher Efficacy Belief Instrument. No significant differences were found, Wilk's Λ = .86, F (1, 25) = 1.26, p = .31, partial η^2 = .14.

Table 5 contains the means and standard deviation on the dependent variable based on science content hours.
"as indicated in Table 5 (Appendix)".

A multivariate analysis of variance was conducted to assess if there were differences between 0 and 1-12 weeks of field based teaching on a linear combination of personal science teacher efficacy, science teaching outcome expectancy and total science teacher efficacy as measured by the Science Teacher Efficacy Belief Instrument. No significant differences were found, Wilk's Λ = .94, F (1, 25) = .51, p = .68, partial η^2= .06.

Table 6 contains the means and standard deviation on the dependent variable based on weeks of field based teaching.
"as indicated in Table 6 (Appendix)".

A multiple regression analysis was conducted to evaluate how total personal efficacy, total outcome expectancy and total teacher efficacy predict student achievement. The predictors were the three efficacy indices, while the criterion variable was student achievement the linear combinations of self-efficacy was significantly related to student achievement, F (3, 16) = 4.96, p =.01. A significant regression equation was found F (3,16) = 4.96, p = .01, with an R^2 of .39. The regression equation is:
8th grade science STAAR = 197.74 + .820 (total personal efficacy) – .04 (total outcome efficacy) – 1.811 (total efficacy).

A second multiple regression analysis was conducted to evaluate how class size predicts total science teacher efficacy. The predictor was class size, while the criterion variable was total teacher efficacy. The linear combinations of class size was not significantly related to efficacy, $F(1,24) = .28$, $p = .60$.

RESULTS

There was no statistical evidence that students of teachers who had a high number of content hours and were alternatively certified scored higher than students of traditionally certified teachers with a lower number of content hours in alternative certified programs, which suggest that the amount of coursework required in alternative certification programs does not make a difference in student achievement (Constantine et. al, 2009).

The results of this study showed little difference in the ranking of concerns, but alternatively certified teachers ranked all areas higher than traditionally certified teachers associated with instructional strategies and pedagogy. Alternative certification programs do not provide as much training in instructional strategies and pedagogy as traditionally certified programs.

The means of science content hours appear to be slightly higher for individuals who have 25+ hours for all three categories of efficacy. A study by Swackhamer, Koellner, Basil and Kimbrough (2009) demonstrated that in-service teacher's outcome efficacy was highest in teachers who had taken more than four science or math courses.

The differences between the means of weeks of field based teaching appear to be slight, it can be assumed that weeks of field based teaching do not affect efficacy. Findings from a study by Sahin and Atay (2010) revealed that overall efficacy scores of teachers had a significant increase from before weeks of field based teaching to after weeks of field based teaching.

This study analyzed efficacy in student engagement, classroom management and instructional strategies. The findings from this study are also compatible with the findings in a study by Fortman and Pontius who revealed that teachers showed a significant gain in efficacy as a result of their weeks of field based teaching.

The multiple linear regressions reflected that high total efficacy was seen as a predictor of student achievement. Teachers with high efficacy often believe they must understand their students, their subject and believe that all children can teach (Deemer, 2004).

The second multiple linear regression focused on class size predicting total science teacher efficacy. Ehrenberg et. al. (2001) compiled research on class size and although one particular study called Project STAR (Student-Teacher Achievement Ratio) reflected that smaller class size yielded higher achievement, reducing class size alone does not affect student achievement.

Scholarly Significance

It is known that content knowledge, pedagogical knowledge, certification route, comfort with various instructional strategies, and enthusiasms for teaching are qualities of effective teachers (Darling-Hammond, 2000). One way to enhance science teaching efficacy is to develop teachers with strong science backgrounds (Yuruk, 2011). By preparing teachers well in content and pedagogy, teachers will have a higher efficacy in science teaching (Lumpe, Czerniak, Haney, & Svetlana, 2012).

The research shows that teachers who had pedagogical training and who received certification produced student achievement scores that were better than those who have not, although some research disputes this finding (Goldhaber and Brewer 2000). Because of this study and other studies similar to it, it can be inferred that the higher the level of self-efficacy, the higher the students' achievement (Mojavezi and Tamiz, 2012).

REFERENCES

Bayraktar, S. (2011). Turskish pre-service primary school teachers' science teaching efficacy beliefs and attitudes toward science: the effect of a primary teacher education program. a*School Science and Mathematics, 111* (3), 83-92.

Bhattacharyya, S., Volk, T., and Lumpe, A. (2009). The influence of an extensive inquiry-based field experience on pre-service elementary student teachers' science teaching beliefs. *Journal of Science Teacher Education*, *20*, 199-218.

Connor, J.P. and Scharmann, L.C. (1996). Influence of cooperative early field experience on preservice elementary teachers' science self-efficacy. Science Education, 80, 419-436.

Constantine, J., Player, D., Silva, T., Kristin, H., Grider, M., and Deke, J. (2009). An evaluation of teachers trained through different routes to certification. Retrieved from https://ies.ed.gov/ncee/pubs/20094043/pdf/20094043.pdf

Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. Retrieved from http://epaa.asu.edu/ojs/article/view/392

Dee, T., and West, M. (2011). The non-cognitive returns to class size. *Educational Evaluation and Policy Analysis, 33* (1), 23-46.

Goldhabher, D. D., and Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Education Evaluation and Policy Analysis, 22,* 129-145.

Kaskaya, A., Unlu, I., Akar, M. S., and Ozturan S. M. (2011). The Effect of School and Teacher Themed Movies on Pre-Service Teachers' Professional Attitudes and Perceived Self-Efficacy. *Educational Sciences: Theory and Practice, 11,* 1778-1783.

Lumpe, A., Czerniak, C., Haney, J., and Svetlana, B. (2012). Beliefs about teaching science: The relationship between elementary teachers' participation in professional development and student achievement. *International Journal of Science Education, 34* (2), 153-166.

Mojavezi, A., and Tamiz, M. P. (2012). The impact of teacher self-efficacy on the students' motivation and achievement. *Theory of Practice and Language Studies, 2* (3), 483-491.

Ramey-Gassert L., Shroyer, M.G., and Staver, J. R. (1996). A qualitative study of factors influencing science teaching self-efficacy if elementary level teachers. *Science Education, 80,* 283-315.

Sahin, F.E. and Atay, D. (2010). Sense of efficacy from student teaching to the induction year. *Procedia Social and Behavioral Sciences, 2,* 337-341.

Skamp, K. and Muller, A. (2001). A longitudinal study of the influences of primary and secondary school, university and practicum on student teachers' images of effective primary science practice. *International Journal of Science Education*, *23* (3), 227-245.

Swackhamer, L.E., Koellner, C.B. and Kimbrough, D. (2009). Increasing self-efficacy of inservice teachers through content knowledge. *Teacher Education Quarterly, Spring,* 63-78.
Texas Education Agency. (2015). Becoming a classroom teacher in Texas. Retrieved from http://tea.texas.gov/Texas_Educators/Certification/Initial_Certification/Becoming_Classroom_Teacher_in_Texas/
Texas Education Agency. (2015). Becoming a certified Texas educator through a university program. Retrieved from http://tea.texas.gov/Texas_Educators/Preparation_and_Continuing_Education/Becoming_a_Certified_Texas_Educator_Through_a_University_Program/
Texas Education Agency. (2014). STAAR 2014 Mean P-Values and Internal Consistency Values by Reporting Category and Content Area. Retrieved from: file:///C:/Users/Robina/Downloads/digest14-appendB-STAAR-Reliability.pdf
Texas Education Agency. (2012). Study Profile: STAAR Biology-ACT Science. Retrieved from file:///C:/Users/Robina/Downloads/staar-eoc-StudyProfile-BI-ACT.pdf
Texas Education Agency. (2012). Study Profile: STAAR Biology-SAT Mathematics. Retrieved from file:///C:/Users/Robina/Downloads/staar-eoc-StudyProfile-BI-SAT.pdf
Tschannen-Moran, M., and Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education, 17,* 783-805
Ucar, S. (2012). How do pre-service science teachers' views on science, scientist and science teaching chance over time in a science teacher training program? *Journal of Science Educational Technology, 21,* 255-266.
Yuruk, N. (2011). The predictors of pre-service elementary teachers' anxiety about teaching science. *Journal of Baltic Science Education*, 10, 17-26.

APPENDIX

Table 1

2013-2014 Region Student Demographics (N=422,509)

Factor	%
Ethnicity	
White	1.7
Hispanic	97.6
African American	0.2
Other	0.5
Economically Status	
Disadvantaged	85.8

Note. Demographic data was obtained from a report release by Texas Education Agency Department of Assesment and Accountability in November of 2014 titled "Enrollment in Texas Public Schools 2013-2014".

Table 2

2013-2014 Region Teacher Demographics (N=26,720)

Factor	%
Ethnicity	
White	9.6
Hispanic	88.7
African American	0.3
Other	1.4
Gender	
Female	70.5
Male	29.5
Education Level	
Bachelor's	82.5
Master's	15.8
No Degree	1.4
Doctorate	0.3
Years of Experience	
Beginner Teacher	6.9
1-5 years	23.2
6-10 years	25.6
11-20 years	26.7
20+ years	17.6

Note. Demographic data was obtained from a report release by Texas Education Agency Department of Assessment and Accountability in November of 2014 titled "Enrollment in Texas Public Schools 2013-2014".

Table 3

Demographics of STEBI

Factor	*N*	%
Gender		
Women	24	77
Men	7	23
Ethnicity		
Hispanic	26	87
White	4	13
Years of Teaching Experience		
0-5	9	29
6-10	8	23
11-15	7	23
16+	7	25
Science Content Hours		
0-24	11	37
25+	19	63
Route of Certification		
Alternative	21	68
Traditional	10	32
Weeks of Field Based Teaching		
0	17	55
1-12	14	45
Class size		
<20	10	34
20-30	14	45
>30	5	17

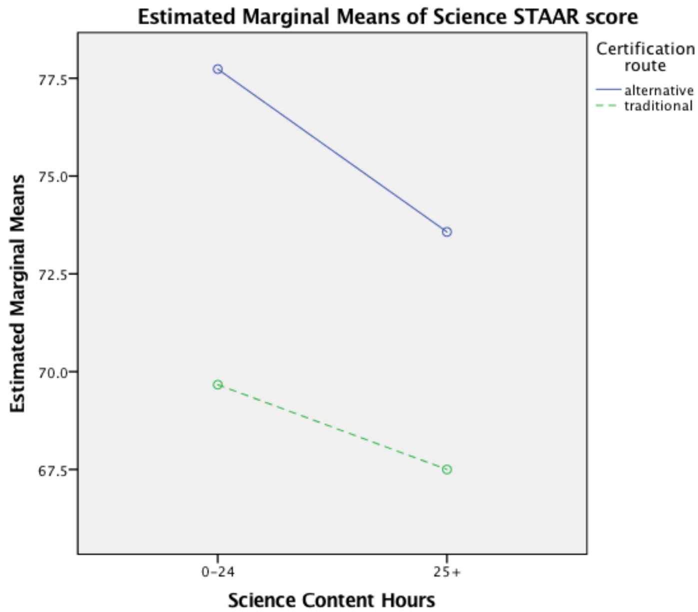

Figure 1. Plot for Student Achievement as a Function of Certification Route and Science Content Hours

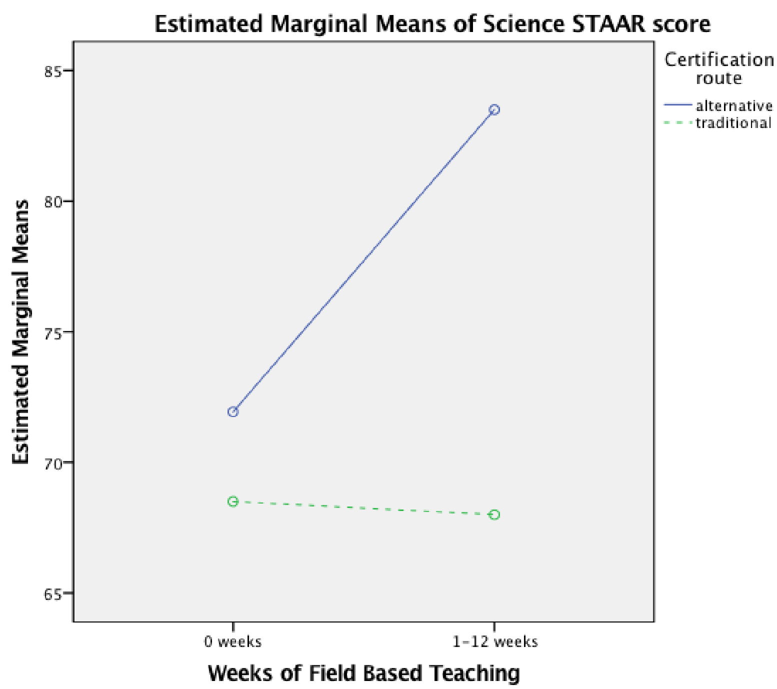

Figure 2. Plot for Student Achievement as a Function of Certification Route and Weeks of Field Based Teaching

Table 4

Means, Standard Deviation, and n for Efficacy as a Function of Certification Route (N=27)

Certification Route	*M*	*SD*	*n*
Personal Efficacy			
Alternative	44.41	3.71	17
Traditional	43.10	5.97	10
Total	43.93	4.61	27
Outcome Efficacy			
Alternative	30.82	2.81	17
Traditional	30.30	4.39	10
Total	30.63	3.41	27
Total Efficacy			
Alternative	87.82	4.32	17
Traditional	89.00	5.33	10
Total	88.26	4.65	27

Table 5

Means, Standard Deviation, and n for Teacher Efficacy as a Function of Science Content Hours (N=27)

Science Content Hours	*M*	*SD*	*n*
Personal Efficacy			
0-24	42.63	6.16	8
25+	44.47	3.85	19
Total	43.93	4.61	27
Outcome Efficacy			
0-24	29.50	4.03	8
25+	31.11	3.11	19
Total	30.63	3.41	27
Total Efficacy			
0-24	86.38	2.88	8
25+	89.05	5.08	19
Total	88.25	4.65	27

Table 6

Means, Standard Deviation, and n for Teacher Efficacy as a Function of Weeks of Field Based Teaching (N=27)

Weeks of Field Based Teaching	*M*	*SD*	*N*
Personal Efficacy			
0	44.00	3.61	15
1-12	43.83	5.80	12
Total	43.93	4.61	27
Outcome Efficacy			
0	31.33	2.89	15
1-12	29.75	3.19	12
Total	30.63	3.41	27
Total Efficacy			
0	88.00	4.58	15
1-12	88.58	4.93	12
Total	88.26	4.65	27