

ALTERNATIVELY CERTIFIED AND TRADITIONALLY CERTIFIED
SECONDARY SCHOOL MATHEMATICS TEACHERS' STUDENT
SUCCESS ON THE MISSOURI ASSESSMENT PROGRAM

A DISSERTATION IN
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and
Mathematics

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by
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Jennifer Joanne Wall, Candidate for the Doctor of Philosophy Degree

University of Missouri-Kansas City, 2009

ABSTRACT

Since the 1980s, alternative certification programs, with the goals of improving the quality and quantity of teachers, have been preparing teachers through streamlined coursework tailored to the individual teachers' needs. Meanwhile, to improve teacher quality, traditional teacher education programs have been increasing standards required for traditional certification. These competing views on how to improve teacher quality have led to debates on the effectiveness of alternative certification programs and the teachers they certify. This study aimed to gain insight into the effectiveness of alternatively certified secondary mathematics teachers from two alternative certification programs offered at two universities. Alternatively certified secondary mathematics teachers from these programs were recruited to participate, and when possible traditionally certified secondary mathematics teachers in the same schools as participating alternatively certified teachers were also involved in the study. Data were collected on the participating teachers' students' 2008 state achievement mathematics test scores. Using analysis of variance and analysis of covariance tests, the data revealed that, on average, students of the alternatively certified

teachers outperformed the students of traditionally certified teachers. Factors that had a significant impact on students' 2008 test scores were students' previous score on the test, students' minority status, and teachers' certification route. While these factors were all significant, students' previous scores accounted for the largest portion of the variance in 2008 scores, and teachers' certification route accounted for the smallest portion. Teachers' number of years of experience was not found to have an impact on students test scores, nor was there a significant interaction between teachers' certification route and students' gender.

This abstract of 257 words is approved as to form and content.

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The undersigned, appointed by the Dean of the School of Graduate studies, have examined a dissertation titled “Alternatively Certified and Traditionally Certified Secondary School Mathematics Teachers’ Student Success on the Missouri Assessment Program,” presented by Jennifer Joanne Wall, candidate for the Doctor of Philosophy degree, and hereby certify that in their opinion it is worthy of acceptance.

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DEDICATION

This dissertation is dedicated to all of my future children and grandchildren with the hopes of inspiring you to always use your talents and to strive to do better than you imagined you could. “Shoot for the moon, and if you miss you will still land among the stars.”

CHAPTER 1

INTRODUCTION

No Child Left Behind (NCLB, 2001) stipulates that all students should have highly qualified teachers. A highly qualified teacher is one who has earned a minimum of a Bachelor's degree, has achieved full certification by the state in which s/he teaches, and has adequate content knowledge in the areas s/he teaches (Spellings, 2005). The combination of this NCLB requirement and the teacher shortage has led to an increase in alternative certification programs for teachers (Brewer, 2003; U.S. Department of Education, 2004; Feistritzer, 2007). In fact, approximately one-third of the nation's new teachers are being certified through alternative routes (Feistritzer, 2007). These alternatively certified (AC) teachers are filling vacancies in the schools or subjects in which many teachers find it hard to teach because of little teacher support or because of high-need students and where schools find it difficult to find qualified teachers because of the school's location or socioeconomic status (Beach & Littleton, 1991; Feistritzer, 2007; Humphrey, Wechsler, & Hough, 2008). Because AC teachers often teach the children with the greatest needs (U.S. Department of Education, 2004; Kane, Rockoff, & Staiger, 2007) an important question is whether or not AC teachers are as effective as the traditionally certified (TC) teachers. The goal of this study is to examine the effect of teacher certification (alternative or traditional) on student achievement in secondary school mathematics courses. To achieve this goal, the researcher will employ a nonexperimental causal-comparative design, one that aims to find a cause-and-effect relationship through the comparison of two groups, to compare student success as

measured by a state achievement test in classes of AC teachers and TC teachers (Gall, Gall, & Borg, 2007; Rao, 1998).

Alternative Certification

In the early 1980s, alternate routes to teacher certification were implemented to improve the quality and quantity of teachers (Brewer, 2003; Suell & Piotrowski, 2006). The increase in quantity of teachers was necessary because of the impending teacher shortage of the early 1980s (AACTE, 1985; Feistritzer, 2007). The focus on improving the quality of teachers was a result of the 1983 release of *A Nation at Risk*, which recommended that education begin attracting and retaining high quality teachers (Erekson & Barr, 1985). To increase the quantity of teachers, AC programs often aimed to recruit males and minorities who were often underrepresented in the teaching workforce (Suell & Piotrowski, 2006). To improve the quality of teachers, AC programs often recruited individuals with successful academic (Evertson, Hawley, & Zlotnik, 1985) and non-traditional backgrounds (Walsh & Jacobs, 2007) who expressed a desire to teach youth.

Currently there are approximately 485 AC programs (Feistritzer, 2007) throughout all fifty states and the District of Columbia. These programs certify about one-third of all new teachers (Feistritzer, 2007) while offering routes to certification that do not involve the individual leaving the workforce to earn a four-year undergraduate degree in an education program (Boe, Shin, & Cook, 2007; Feistritzer, 2007; Walsh & Jacobs, 2007).

In general, AC programs provide a certification route to teaching unlike the traditional 4- or 5-year undergraduate programs (Owings et al., 2006). AC programs are also

very diverse in their structures, formats and goals as programs differ in the amount of coursework required, the timeline of coursework and field experiences, the school districts they serve and the institutions that offer the program (Conklin & Zeichner, 2005). However, six common characteristics exemplify AC programs: (a) the programs are field-based – take place in the elementary, middle, and secondary schools; (b) program participants have a bachelor’s degree prior to starting the program; (c) the program participants must pass an admissions process; (d) program participants complete coursework while teaching; (e) program participants and mentor teachers work closely together; (f) in order to complete the program, participants must demonstrate high performance on specified standards (U.S. Department of Education, 2004). These elements are similar to those prescribed by AACTE in 1985 during the creation of the first AC programs: rigorous admission standards, coursework that develops pedagogy, supervised field experience, and a test of content knowledge (AACTE, 1985). Additional AC program characteristics deemed important by one educational researcher with a focus on improving urban education are that AC programs recruit minorities so that the demographics of the pool of candidates mirrors that of American society, and that teachers earning certification after completing the AC program must have demonstrated effectiveness with students in the classroom (Haberman, 2001). Despite the wide variety of AC program structures, many of these common themes describe AC programs in general terms.

Since the implementation of alternative certification, researchers have studied programs to identify successful programs and elements of successful AC programs. While the definition of successful programs may vary among researchers, some outcomes of

successful programs might be teacher retention, teacher efficacy, teachers' knowledge of teaching such as instructional techniques and classroom management (Humphrey et al., 2008). Walsh and Jacobs (2007), in conjunction with the National Council on Teacher Quality, researched the original goals of AC programs to determine if current AC programs were meeting the requirements set out at the conception of the idea of alternative certification. In doing so, they identified ideal elements of AC programs', components of which can be categorized into five areas: recruitment of AC teachers, AC teachers' content knowledge, AC programs' coursework and format, mentorship of AC teachers, and AC teachers' placement in schools.

According to Walsh and Jacobs (2007), AC programs must recruit individuals who either demonstrated academic success through high grade point averages or, if the individual has been in the workforce for a number of years, good work experience and performance on the job. Second, AC teachers must demonstrate abilities in the content area they will be teaching (Beach & Littleton, 1991; Walsh & Jacobs, 2007). They may either have demonstrated high content knowledge before entering the program or be able to do so through content coursework in the AC program (Humphrey et al., 2008).

The third identified component of effective AC programs is the coursework. Because AC teachers earned bachelor's degrees prior to entering the program, they take streamlined coursework similar to what beginning teachers need to be successful in the classroom (Beach & Littleton, 1991; Walsh & Jacobs, 2007). The coursework must also be tailored to each AC teacher's needs based on the teacher's background and the school in which the teacher will teach (Humphrey et al., 2008). The AC programs, throughout the coursework,

must also develop collegial relationships between and among AC teachers and their peers (Beach & Littleton, 1991).

Another important component of AC programs includes mentorship of AC teachers through a practice teaching experience the summer before their first year as a teacher and/or through a full-time mentor during their first year (Walsh & Jacobs, 2007). As is true for all beginning teachers, mentors need to help AC teachers plan for their classes by sharing curricula and instructional strategies and by demonstrating techniques to design and deliver lessons. They must also take time to frequently observe the AC teachers and provide feedback on the AC teachers' performances (Beach & Littleton, 1991; Humphrey et al., 2008). Depending on the program's format, the mentors may be provided by the district or by the AC program.

The last component of successful AC programs is the placement of AC teachers in the field; AC teachers must be placed in schools with strong leadership and necessary resources, such as teaching materials, so that the AC teachers can be successful (Humphrey et al., 2008). Additionally, AC teachers need to have dispositions that complement the cooperating school (Beach & Littleton, 1991). The teachers' goals and philosophies must be in line with the cooperating schools' (Beach & Littleton, 1991).

This study focused on two AC programs that certify secondary mathematics teachers. Both of the AC programs were designed in accordance with Missouri's Department of Elementary and Secondary Education requirements (Missouri Department of Elementary and Secondary Education, 2009). One of these AC programs, Program 1, is offered by an urban university in the Midwest, and the other, Program 2, is offered by a

regional university in a rural setting. While AC teachers from both programs are teaching in urban, suburban, and rural settings, there are more teachers from Program 2 in rural settings than from Program 1 and more teachers from Program 1 in urban settings than from Program 2. This is because the AC programs are designed to meet the needs of area school districts at the middle and secondary levels, and Program 1 has an urban mission, and Program 2 is in a rural setting.

Both AC programs have many features of successful AC programs as described above. For example, both programs require that participants have a minimum 2.5 overall GPA; however at least in Program 1, over 65% of program participants maintain a minimum of a 3.0 GPA. Both programs' participants must also pass the PRAXIS-II examination in the area in which they teach during the first semester of classroom teaching, or they are screened out because they lack vital content knowledge for successful entry for certification. Requiring applicants to pass the PRAXIS-II examination and requiring them to have a baccalaureate degree in either mathematics or a closely related field helps in ensuring the AC teachers demonstrate content knowledge, one of the elements of successful AC programs, prior to beginning the program.

Another component of successful AC programs that these programs exhibit is streamlined coursework tailored to individuals' needs. In terms of coursework necessary for certification, Program 1 requires AC teachers to complete 24 to 36 hours of coursework that focus on child development and pedagogy as required by the state's Department of Education. Thus, the courses required by Program 1 cannot be altered for each program participant as recommended by those researching successful AC programs. Because the

courses are prescribed and not tailored to individuals, assignments within the courses are tailored to the individuals based on their prior experience and the schools in which they are teaching. In Program 2, a degree audit is performed for each participant to determine which courses the participant needs in order to complete subject area requirements. The participants are divided into two different cohorts based on the schools in which they teach. One cohort is tailored to teachers in rural settings, and one is tailored to teachers in urban settings. These mentoring paths meet the individuals' needs based on the school districts in which they teach.

Another component of successful AC programs is the development of collegial relationships among AC teachers, and the coursework offered by both programs aims to do so. According to the Director of Alternative Certification for Program 1, certain courses in Program 1 meet bi-weekly and have a main objective to develop relationships and collegiality among the AC teachers in the program. Additionally, Program 2, being a cohort style program as described above, helps to develop collegiality among participants.

As described above, a strong mentoring component is necessary in successful AC programs (Beach & Littleton, 1991; Humphrey et al., 2008; Walsh & Jacobs, 2007). Program 1 requires university supervisors to visit AC teachers' classrooms four times per semester, and Program 2 requires a supervisor to visit the classroom six times during their two-year participation in the program. In addition, in Program 1 the school in which the teacher teaches provides a mentor teacher in the same grade level and content area whose classroom is in close proximity to the AC teacher. The mentoring efforts within the district

are not monitored by the University. Thus, there is a lack of information about the effectiveness of the mentoring program.

A component of successful AC programs that these programs do not easily meet is the placement of AC teachers in districts that will provide AC teachers with support and resources. School districts approved by the state's Department of Education are eligible to hire teachers involved in the AC programs. While Program 1 helps teachers find districts that are hiring, they are not involved in the hiring process. Additionally, districts that have adequate resources and that offer support to new teachers are not often in need of hiring AC teachers; instead, AC teachers often fill vacancies in schools in which many teachers find it hard to teach (Beach & Littleton, 1991; Feistritz, 2007; Humphrey et al., 2008).

Another component of successful AC programs described above is recruitment. Neither of the programs involved in this study actively recruits individuals; however neither program is an open-enrollment program, and not all applicants are accepted. To be accepted into either program, Missouri law requires that candidates must have a bachelor's degree in mathematics or a closely related field as determined by the school district, the University and the state.

The AC programs used in this study have a number of components of successful AC program requirements (a) high content knowledge by AC teachers, (b) strong mentoring and collegiality within the university, and (c) assignments that are tailored to AC teachers' backgrounds and placements. However, some of the components of successful AC programs, (a) recruitment of potential AC teachers, (b) placement in schools with strong leadership and mentor teachers, (c) and entire courses tailored to students' backgrounds and

placements in the field, are not as prominent in the AC programs used in this study. Given these characteristics of the AC programs and because the link between teacher effectiveness and certification route is hotly debated (Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005), the purpose of this study is to determine if secondary mathematics teachers who complete these AC programs are as effective as TC teachers in the same school districts. To better understand differences between AC teachers and TC teachers, it is first necessary to describe traditional certification programs.

Traditional Certification

In most states, the majority of teachers are certified through traditional programs. States approve individuals for teaching certification once they have completed the requirements of approved traditional certification programs and have passed all necessary teacher certification requirements. The traditional certification programs require courses in educational foundations, pedagogy and content knowledge in a discipline, such as mathematics, social studies or science. Traditional certification programs also require individuals to complete field experiences so that the individuals can apply knowledge from educational courses to the classroom environments. States' requirements for TC programs vary, specifically in the duration and number of field experiences required although most states require knowledge of classroom management and content-specific pedagogy (Boyd, Goldhaber, Lankford, & Wyckoff, 2007).

The effects of certification type on teacher effectiveness is widely debated, and thus a necessary topic of study. Prior to determining the effectiveness of AC teachers in these AC

programs, it is necessary examine the literature to determine what characterizes teacher effectiveness.

Defining Teacher Effectiveness

The constructs of teacher effectiveness and teacher quality, terms used interchangeably by some educational researchers and well-known education accrediting agencies, like NCATE and AACTE, are “the knowledge, skills, abilities, and dispositions of teachers” (Mitchell, Robinson, Plake, & Knowles, 2001, p. 19). Laczko-Kerr and Berliner (2002) state that teacher quality encompasses teachers’ content knowledge, academic performance, degrees earned and teaching experience. However, Owings et al. (2006) state that the contemporary notion of teacher quality is viewed mainly through the lens of student learning and student achievement. Another description of teacher quality encompasses three aspects including teachers’ classroom practices, teachers’ professional development, and teachers’ characteristics external to the classroom (e.g. educational attainment) (Wenglinsky, 2002).

Researchers’ definitions of teacher effectiveness vary, and as society has changed, the definition or notion of teacher effectiveness has evolved. Mitchell and his colleagues (2001) traced the evolution of society’s definition of teacher effectiveness and found that historically teacher effectiveness was mainly focused on a teacher’s morality. Teachers were expected to help develop social values in their students, which was more important than gains in student achievement. Over time, cultural and educational values were deemed important aspects of teacher effectiveness as well. During the post-Sputnik era, society

became increasingly concerned with teachers' ability to teach the prescribed curricula. The contemporary notion of teacher effectiveness differs from previous definitions in that it acknowledges the diversity of students and situations, stresses the importance of rigor and student engagement in meaningful learning activities, and deemphasizes a teacher's characteristics (Mitchell et al., 2001). It wasn't until the Coleman Report was released in 1966 that student achievement was used as a measure of teacher effectiveness (Walsh, 2001), providing further evidence that the notion of teacher effectiveness has changed over time.

The standards of the three main national educational organizations, Interstate New Teacher Assessment and Support Consortium (INTASC), National Council for Accreditation of Teacher Education (NCATE) and National Board for Professional Teaching Standards (NBPTS), encompass all important aspects of teacher effectiveness, and together these standards provide a contemporary definition of teacher effectiveness. Themes common to these prominent organizations' teacher standards are (a) commitment to students and students' learning, (b) deep subject matter knowledge, (c) management and monitoring of student learning, (d) reflection on teaching, and (e) involvement in a broader community (Mitchell et al., 2001). As student learning is included in two of these common themes in teacher education program standards of these three organizations, and because teacher effectiveness has a greater impact on student learning than any other variable in schooling (Marzano, 2006), this researcher used student learning, to assess teacher effectiveness.

Assessing Teacher Effectiveness Using Student Achievement

While student learning and student achievement are used interchangeably by some educational researchers, the following is worth noting: Student learning includes what a student has learned throughout the school year. Unfortunately state assessment tests cannot fully assess student learning in a given subject area; thus student achievement on these tests cannot fully reflect student learning. Students learn content and concepts that are not addressed on tests, and state achievement tests might have items that were not part of the enacted curriculum of the classroom (Hewitt, 2006; Madaus, Clark, & O'Leary, 2003). However, state achievement tests can assess students' knowledge of a representative sample of the state's standards or learning expectations. Thus, student achievement on a state achievement test gives a measure of insight into student learning.

Educational researchers often use student achievement to measure teacher effectiveness (see for example Darling-Hammond, Holtzman, Gatlin & Heilig, 2005; Laczko-Kerr & Berliner, 2002; Miller, McKenna, & McKenna, 1998). Additionally, researchers, the public, educators and policy makers recognize test scores as an objective means to measure student achievement (Rockoff, 2004). Various studies, cited and described below, have been conducted to assess the effects of a variety of teacher characteristics (demographics, education, and experience) on teacher effectiveness and student achievement.

Ehrenberg, Goldhaber and Brewer (1995) studied the effects of teachers' demographics, specifically race, gender and ethnicity, on student achievement. Using National Educational Longitudinal Study of 1988 data, researchers found that students'

improvement from their eighth grade to their tenth grade test was not affected by teachers' race, gender and ethnicity (Ehrenberg, Goldhaber, & Brewer, 1995). Through teacher surveys, the researchers found that teachers perceive the abilities and potentials of their students differently based on both teachers' and students' race, gender and ethnicity. For example, white female teachers have more positive perceptions of their white female students than they do of other groups of students including white males, minority males and minority females (Ehrenberg et al., 1995). While teachers' perceptions potentially influence their relationships with their students and how the teachers will track students into future classes, it can have an impact on the students' achievement in future courses. This is particularly relevant in urban schools with high populations of students of color. If AC programs provide a means for minorities to enter the teaching profession in urban schools, the students would benefit from the minority teachers as evinced from the results of how teachers' gender and race affect their perceptions of their students based on the students' gender and race as found in Ehrenberg's et al. (1995) study.

Teachers' education and its effect on student achievement have been studied as well. For instance, four studies examined whether the highest degree a teacher earned is related to student achievement. The first study focused on public school students' gain scores between their sophomore and senior years and found that teachers having master's degrees tended to negatively affect white students' achievement, and positively affect black students' achievement (Ehrenberg & Brewer, 1994). The other three studies did not disaggregate results by ethnicity of student, and found that teachers' advanced degrees do not affect student achievement. Goldhaber and Brewer (2000) found that teachers with advanced

degrees did not have students who scored higher on test scores between their tenth and twelfth grade years, and Wenglinsky (2002), through the use of National Assessment of Educational Progress (NAEP) data from 1996 also found the same to be true for eighth grade students. For third through seventh grade students in Texas, teachers having a master's degree did not lead to an increase in student achievement (Rivkin, Hanushek, & Kain, 2005). These four studies indicate that obtaining master's degrees or advanced degrees does not positively affect teachers' students' achievement; however, the studies did not specify the type of master's degrees earned by the teachers. Whether or not the master's degrees were in the content area in which the teachers taught may impact teachers' effectiveness (Walsh, 2001).

Teachers' highest earned degrees are not the only factor of teachers' education that was studied in relation to student achievement. Two of the studies described above (Goldhaber & Brewer, 2000; Wenglinsky, 2002) also examined whether the teacher having a major or minor in the content area affects student achievement. Findings indicate that majors and minors positively affected student achievement between tenth and twelfth grade and in eighth grade, respectively. Another aspect of teachers' education studied to determine its effect on student achievement was the selectivity of the institution the teacher attended. The study found that teachers who attended highly selective colleges positively affect both white and black students' achievement between their tenth and twelfth grade years (Ehrenberg & Brewer, 1994). Results from these studies indicate that teachers' educational background may provide insight into the future success of his/her students.

Another teacher characteristic that has been studied is years of teaching experience. Rockoff (2004) evaluated mathematics and reading scores over a 10 year period. He found that for elementary students in reading, the teachers' number of years of experience positively impacts student achievement. However, in mathematics teachers' experience affected mathematics computation test scores but not mathematics concepts test scores (Rockoff, 2004). Rivkin, Hanushek and Kain (2005) found that for third grade through seventh grade students in Texas, there were improvements in students' achievement after the initial year of teaching. However, after three years of teaching experience, student achievement was not affected. Ehrenberg and Brewer (1994) conducted a study using data from the longitudinal *High School and Beyond* study and found that, specifically for Latino/Latina students, the teachers' years of experience was negatively related to student achievement. Because academic success of minority students is important, the current study examined student success of AC and TC teachers by ethnicity to see if there is a difference.

In summary, previous studies indicate that the teacher characteristics shown to affect student achievement to some degree have been teachers' major or minor area of study and teachers' number of years of experience. Another teacher characteristic, certification route, is the focus of Chapter 2 because the link between teacher effectiveness and certification route is hotly debated (Darling-Hammond et al., 2005). Of the few studies that have been conducted on teacher certification (Walsh, 2001), the research findings are mixed on the relationship between the teacher's route to certification and the teacher's effectiveness. The proposed study seeks to evaluate and compare the effectiveness of AC teachers and TC

teachers by comparing the performance of their students on Missouri state achievement test scores in mathematics.

Research Questions

In this study, the following research questions were addressed.

1. Does the type of teacher certification (alternative or traditional) affect student achievement on the mathematics portion of the MAP test?
2. Does the type of teacher certification (alternative or traditional) impact mathematics MAP test scores by student gender differently?
3. Does the type of teacher certification (alternative or traditional) impact mathematics MAP test scores by student race differently?
4. Is there an interaction between student race and gender on mathematics MAP test scores of students taught by traditionally certified and alternatively certified teachers?

Definition of Key Terms

The current study requires specific terms which will be defined according to its application to the study.

Alternative Certification or Alternative Route to Certification Alternative teacher certification is a means to certification that does not involve the traditional bachelor's degree in education and/or an unpaid student teaching experience; however, many, but not all, AC programs are offered through colleges and universities. Alternatively certified teachers begin teaching with little to no educational preparation (field experience and pedagogy, for

example) and are mentored throughout their first few years of teaching. They also take education courses during their first few years until they earn certification.

Depth of Knowledge (DOK) Levels are assigned to test items based on the level of reasoning necessary to answer the item. The four DOK levels are recall, skill/concept, strategic thinking and extended thinking.

Grade Level Expectations (GLEs) are objectives for the five content areas of the Missouri Standards: (a) Number and Operations, (b) Algebraic Relationships, (c) Geometric and Spatial Relationships, (d) Measurement, and (e) Data and Probability, and specific objectives, GLEs, are articulated at each grade level.

In-service teachers are teachers who are currently teaching students in schools as compared to *pre-service teachers* who are preparing to enter a teaching career.

MAP Test The Missouri Assessment Program (MAP) test is a state achievement test. Completed by students at the secondary level, in the 6th, 7th, 8th, and 10th grades, the test includes selected response sections (commonly known as a multiple choice) one of which is the nationally-normed *TerraNova* test, and the MAP test also includes a constructed response section. In the constructed response section, students must show all their work used to arrive at the answer. In 8th and 10th grades, the test also includes a performance event, an item that requires higher levels of thinking and often may be solved using multiple approaches. Embedded in the MAP test are field test items. These are not used to calculate students' scores on the test.

Race/Ethnicity Race or ethnicity refers to an individual's heritage and/or culture. Five categories of race/ethnicity, based on the ones used by the Missouri's department of

education, were used in this study: Asian/Pacific Islander, Indian, Black (not Hispanic), Hispanic, White.

Student Learning Student learning is what a student has learned from the enacted curriculum.

Student Achievement Students' success on a state achievement test is one measure of student achievement. The test assesses portions of the curriculum and the students' achievement on the test is a measure of student learning.

Teacher Effectiveness Teacher effectiveness includes the knowledge, skills and dispositions a teacher possesses and demonstrates. Effective teachers are committed to and continuously monitor students' learning and reflect and improve on their teaching.

Traditional Certification Traditional teacher certification programs are offered by colleges and universities. Students earn a bachelor's (or master's) degree after completing content courses, education courses and a student teaching experience that, in Missouri, is generally a semester long. Missouri issues certification after the candidate completes a TC program and passes a content exam such as the PRAXIS-II.

CHAPTER 2

REVIEW OF LITERATURE

This chapter will review the following areas of research: the types of teachers alternative certification (AC) programs often attract, the differences in the levels of preparedness and in the teaching practices of AC and traditionally certified (TC) teachers, and finally on the effectiveness of AC and TC teachers as measured by student achievement. First, while the vision of alternative certification programs has shifted to improving teacher quality (Cohen-Vogel & Smith, 2007), many alternative certification (AC) programs were instituted with the goal of bringing additional teachers into the classroom to help alleviate the teacher shortage. Many designers of AC programs believed that one way to attract more teachers into the profession was to diversify the demographics of in-service teachers. The following sections review the literature on the types of teachers AC programs often attracted.

Demographics of Traditionally versus Alternatively Certified Teachers

Alternative certification programs often have a goal of attracting quality teachers to the classrooms, and the literature suggests that AC teachers and traditionally certified (TC) teachers differ in the following ways. One claim is that AC teachers are often older than TC teachers and are more often career-changers or people who worked outside of education before entering into the AC program (Owings et al., 2006; U.S. Department of Education, 2004). Also, AC programs are thought to attract more males and more minorities than TC programs do (Owings et al., 2006; Shepherd, 1999; Suell & Piotrowski, 2006). Further, it is

commonly perceived that AC programs attract college graduates with high grade point averages (GPAs) or advanced degrees as prospective teachers (Shen, 1999). Research studies investigating these claims are presented below.

Age. The first belief is that AC programs attract older adults than TC programs. Humphrey and Wechsler (2007), through their case study of seven AC programs that certified either or both elementary and secondary teachers, found that the average age of AC participants was only slightly higher than the average age of all beginning teachers (32 years old as compared to 29 years old, respectively). However, when looking at individual AC programs, one AC program's participants were significantly younger (23 years old) than the national average for AC participants, and two programs had participants that were significantly older than the national average (both with an average age of 38 years old). The study results attributed these variations to the recruiting practices of the AC programs. They also demonstrated that the variation in ages among AC programs ranged from about 22 to 63 years of age, and AC programs recruited a diverse mix of young and older adults (Humphrey & Wechsler, 2007).

Shen (1999) conducted a study to determine if AC programs attracted older adults specifically into mathematics and science teaching. Shen (1999) used data from the Schools and Staffing Survey (SASS) of 1993-1994 to ensure that the sample was nationally representative. While Shen (1999) did not indicate that the teachers are secondary teachers, because they are mathematics or science teachers, it is likely they are not elementary teachers. Unlike the aforementioned study by Humphrey and Wechsler (2007), Shen (1999) did not only include beginning teachers in the study but rather used teachers who had been

certified within ten years of data collection. While this study found that while the average age of AC mathematics and science teachers was slightly higher, although not significantly, than the average age of TC mathematics and science teachers (Shen, 1999), the number of years of teaching experience was not considered. The average age may have been statistically the same, but AC teachers may or may not have begun teaching later in life than TC teachers, and this was not addressed in the study. The current study of focus in these pages included the number of years teaching experience of each teacher.

While neither Shen's (1999) nor Humphrey and Wechsler's (2007) studies demonstrated that AC programs attract older adults into teaching, a commonly-held notion about AC programs, the results of Boser and Wiley's (1988) and Houston, Marshal and McDavid's (1993) studies were different. Boser and Wiley (1988) surveyed graduates of three teacher education programs (an undergraduate program, a post-baccalaureate program, and an AC program) at the University of Tennessee, Knoxville. All teachers in the study were secondary teachers. Findings revealed that the undergraduates were significantly younger than post-baccalaureates and AC program participants, but the AC program participants and post-baccalaureates' ages did not differ significantly (Boser & Wiley, 1988). Likewise, Houston, Marshall and McDavid (1993) collected demographic information of a sample of first-year elementary teachers in Houston, Texas and determined that the average age of first-year TC teachers was significantly younger (27.6 years) than first-year AC teachers (32.4 years).

The above studies examined the belief that AC programs attract older adults into teaching than TC programs. The results of the studies varied, and one might surmise that the

age of the AC teachers is reflective of the recruiting practices of the AC programs. Based on the varying results of these studies, available research does not support the notion that AC teachers are generally older than TC teachers.

Career-changers. A second common assumption about AC programs is that AC programs attract career-changers into the teaching profession – those leaving a different profession to go into teaching. In fact, in a testimony to the Committee on Education and Labor, the president of the National Center for Alternative Certification reported that the majority of AC teachers are career-changers (Feistritzer, 2007). Humphrey and Wechsler (2007) addressed this assumption and found that 18% of the elementary and secondary participants in the seven AC programs in their case study were previously full-time students and 24% were either a K-12 teacher or were in another educational or childcare profession. However, despite the findings that 58% of the AC program participants were neither full-time students nor employed in education prior to participation in the AC program, the researchers reported that the AC programs in these studies were most likely to involve people who were most recently students or involved in educational professions (Humphrey & Wechsler, 2007).

Shen's (1999) study of the SASS (Schools and Staffing Survey) data from 1993-1994 revealed that while about 24% of AC mathematics and science teachers (likely secondary teachers) were previously in educational professions as compared to 12% of TC mathematics and science teachers. Twenty-five percent of AC mathematics and science teachers and 16% of TC mathematics and science teachers were employed outside of education before entering the teaching profession. The remaining AC and TC teachers were

either previously unemployed or in college. Shen (1999) concluded that while there is a significant difference in their main activities before entering the teaching profession, a low percentage of mathematics and science teachers in AC programs had a prior career path in education and that AC programs recruit teachers with varied prior work experiences.

Cohen-Vogel and Smith (2007) used data from the SASS (Schools and Staffing Survey) collected in 1999-2000 to determine if many of the AC elementary and secondary teachers in their first year of experience in the nationally representative sample were career changers. The researchers found that prior to the AC teachers' first year of teaching experience, 36.3% of AC teachers were in college, 20.7% were teaching at various levels, 12.5% were working in education but not teaching, and only 17.7% of the AC teachers were working in fields other than education before their first year of teaching. While the percentage (17.7%) of AC teachers not previously in the field of education was higher than the percentage (5.5%) of TC teachers working outside the field of education, it was not statistically significant. The findings for TC teacher's previous experience included 48.8% who were in college (significantly higher than that of AC teachers, 36.3%), 21% who were teaching at various levels, and 7.8% who were working in education but not as teachers. The researchers concluded, as did the aforementioned studies by Shen (1999) and Humphrey and Wechsler (2007), that while more AC teachers are career changers than TC teachers, the assumption that AC programs principally certify teachers who are career-changers is not valid (Cohen-Vogel & Smith, 2007).

Gender. A third claim is that AC programs often recruit more males into teaching than TC programs do. Humphrey and Wechsler (2007), in their case study of seven AC

programs certifying either or both elementary and secondary teachers, addressed this claim and found that only slightly more males are certified through alternative routes. However, they did find that some AC programs in their case study did attract significantly more males into teaching. Thus the variation in the number of males between programs is notable and possibly a result of recruiting practices (Humphrey & Wechsler, 2007). Similarly, Shen's (1999) study of 1993-1994 SASS (Schools and Staffing Survey) data found that, for mathematics and science teachers, there is not a significant difference in the number of males AC programs certify. However, the demographic information Houston, Marshall and McDavid (1993) collected from first year elementary teachers in Houston showed that there was a significantly higher percentage of AC teachers who were male (24%) as compared to TC teachers (6%). Thus the common notion that AC programs attract more males into teaching cannot be generalized to all AC programs.

Minorities. Minority groups have historically been underrepresented in the teaching profession with 90% of all teachers being white (Humphrey & Wechsler, 2007). It is a commonly-held belief that AC programs attract more minorities into teaching (Suell & Piotrowski, 2006). Shen's (1999) study of 1993-1994 SASS (Schools and Staffing Survey) data did not support this claim, revealing that the difference in the percentage of AC mathematics and science teachers who are minorities (15%) is not significant as compared to the percentage of TC mathematics and science teachers that are minorities (12%). However, Humphrey and Wechsler (2007) found that 40% of the elementary and secondary AC teachers in their seven case study programs were minorities while the National Center for Education Statistics reported that 14% of elementary and secondary AC teachers nation-

wide were minorities. However, Humphrey and Wechsler (2007) concluded that the demographics of the program participants reflected the demographics of the area in which the program was implemented suggesting that no generalizations should be made concerning the diversity of AC teachers. Instead it is likely that the diversity of participants is subject to the demographics of the area the AC program serves (Humphrey & Wechsler, 2007). Conclusions regarding the notion of AC programs recruiting more minorities into teaching are similar to those involving gender and age – they are dependent on the recruiting practices of the AC programs.

Higher achievement. Many supporters of AC programs claim that AC programs attract teachers with higher achievement in school in terms of grade point average (GPA), test scores and degrees earned (Shen, 1999). Boser and Wiley (1988) assessed the validity of this claim. The secondary teachers in their study had been certified through one of three programs: a traditional four-year bachelor's degree, postbaccalaureate students completing education courses to earn certification, or a one-year AC program. They found that the AC participants' median score (83, 96, 89) on all three sections (Communication, General Knowledge and Professional Knowledge, respectively) of the National Teacher Examination (NTE, a teacher licensure exam) were higher than the post-baccalaureates' medians (79, 90, 87) which were higher than the undergraduates' median scores (72, 71, 67). The difference in the undergraduates' and post-baccalaureates' NTE scores on the General Knowledge section were significant as were the differences in AC and undergraduates' scores on General Knowledge and Professional Knowledge. The post-baccalaureates' scores and the AC participants' scores did not differ significantly (Boser & Wiley, 1988).

Shen's (1999) study on 1993-1994 SASS (Schools and Staffing Survey) data revealed that 73.5% of AC mathematics and science teachers had earned an associate or bachelor's degree as the highest degree as compared to 62.5% of TC mathematics and science teachers. However, 7.9% of AC mathematics and science teachers had earned a degree higher than a master's as compared to 3.9% of TC mathematics and science teachers. These two studies do not support generalizations over time regarding the educational attainment of AC teachers in terms of achievement on tests or on obtaining advanced degrees.

Relieve teaching shortage. Another original goal of AC programs was to relieve the teaching shortage in hard-to-staff schools and in high-need content areas (Cohen-Vogel & Smith, 2007). Cohen-Vogel and Smith (2007) found, through their study of the 1999-2000 SASS (Schools and Staffing Survey) data for elementary and secondary teachers, that the percentage of AC teachers (40%) and the percentage of TC teachers (35.9%) in hard-to-staff schools were not statistically different. Likewise, the percentage of AC teachers teaching at least one class out-of-field (42.3%) was not statistically different than that of TC teachers (41.1%) (Cohen-Vogel & Smith, 2007). Generalizations cannot be made about the number of AC teachers in hard-to-staff schools or high-need content areas without examining the specific school of interest.

Summary. One can conclude based on study results that participants of AC programs cannot be easily categorized as older adults, career-changers, males, minorities or high achieving students. Similarly, hard-to-staff schools and high-need content areas cannot be assumed to be staffed or taught by AC teachers. Instead, research supports the conclusion

that AC teachers are at least as, if not more, diverse as TC teachers. Also, AC programs provide a means for prospective teachers to enter the teaching field. However, these demographics about AC and TC teachers do not address the effectiveness of the teachers, and the question still remains, are AC teachers as effective as TC teachers?

Teacher Preparedness

Teacher effectiveness can be measured in a variety of ways. The following is a review of studies that have assessed teacher effectiveness through teacher preparedness, teaching practices, and/or student achievement. In Houston, Marshall and McDavid's (1993) survey of first-year elementary AC and TC teachers in Houston, Texas, the researchers asked participants to rate their own experience with common problems faced by first-year teachers. Participants completed the survey after two months of teaching and again after eight months of teaching to gauge teachers' self-perceptions of their preparedness to teach. The results of the data collection after two months of teaching showed that AC teachers indicated higher level of concerns in all fourteen areas than the TC teachers did. The difference in levels of concern was significant in six of these areas: motivating students, time management, paperwork, school administration, amount of personal time, and assessing students. However, after eight months of teaching, TC teachers expressed higher concern than they had after the first survey while AC teachers experienced fewer problems. This resulted in TC teachers rating only classroom management as higher concern than AC teachers. Thus, according to this study, after eight months of teaching, both AC and TC

teachers experience relatively similar feelings of preparedness (Houston, Marshall, & McDavid, 1993).

Miller, McKenna and McKenna (1998) conducted research involving TC and AC teachers with three years of middle school teaching experience. All AC teachers had graduated from a southeastern university, and each TC teacher selected matched an AC counterpart on subject and grade taught in the same school. The researchers interviewed each participant to learn about the teachers' perceptions of their teaching experience when they first began teaching, their current competency level, and their perceptions of the problems they faced in their teaching experience. The interviews revealed that both AC teachers and TC teachers expressed similar feelings of unpreparedness, but TC teachers commonly commented that having such feelings was part of teaching. In contrast, the AC teachers attributed the unprepared feelings as having not been through a TC program (Miller, McKenna, & McKenna, 1998).

Similarly, Cohen-Vogel and Smith (2007) used SASS (Schools and Staffing Survey) data collected in 1999-2000 on elementary and secondary AC and TC teachers to determine their self-perceived level of preparedness during their first year of teaching. The data showed that no significant differences were found between AC and TC teachers' self-perceived preparedness (Cohen-Vogel & Smith, 2007).

Foster, Mantle-Bromley, Wayman and Wilson (2003) also surveyed first-year teachers (level, elementary or secondary, is not specified) who were certified either through traditional programs in Colorado or an alternative route program, Teachers in Residence. Participants rated their level of uneasiness or apprehension on common concerns of first-

year teachers. The findings revealed that first-year teachers in both groups rated their concerns similarly. Areas of higher concern were common to both groups of teachers, as were areas of lower concern. However, AC teachers indicated higher levels of uneasiness or apprehension than did TC teachers in nearly every area surveyed, especially in effective instruction and classroom management (Foster, Mantle-Bromley, Wayman, & Wilson, 2003).

Sindelar, Daunic and Rennells (2004) used Principal Questionnaires and Graduate Questionnaires to gain insight into special education (no grade level given) TC and AC teachers' levels of preparedness and efficacy. The researchers gathered a sample of teachers from four TC programs, three university-district degree program partnerships and three district add-on programs. The latter two programs are considered to be AC programs, but no program descriptions were provided. Principals and teachers responded to questions on a Likert scale to indicate the teachers' level of preparedness. The principals rated graduates of both AC programs higher than they did the TC programs. The research concluded that this may be due in part to the fact that some of the AC teachers were previously paraprofessionals in the schools. The surveys completed by the teachers showed that AC teachers had better knowledge on school and classroom procedures and routines; however, there was no difference on the teachers' levels of instructional preparedness, classroom management skills and ability to meet students' needs (Sindelar, Daunic, & Rennells, 2004).

In summary, results from the aforementioned studies indicate that AC teachers did not feel better prepared or feel less apprehension than TC teachers did. However, the reasons AC teachers and TC teachers gave for feeling unprepared in certain areas differed as a result

of their route to certification. However, teachers' self perceptions of their levels of preparedness may or may not be related to teaching effectiveness (Darling-Hammond, Chung, & Frelow, 2002). Teaching practices also influence teachers' effectiveness, and the following section reviews the literature addressing teaching practices.

Teaching Practices

Ng and Thomas (2007) conducted a case study involving two highly successful AC secondary science teachers to determine what qualities they shared which may have contributed to their success as teachers. The research found that the teachers' past experiences and their reflections on these experiences had the biggest impact on teaching practices and success. The two successful teachers shared the following teaching practices: (a) focusing on the students rather than on themselves, (b) advocating for the students, and (c) having confidence in their classroom management which resulted from aiming to develop their students academically, emotionally and socially rather than focusing on skills and procedures. The final theme in this study focused on professional collaboration. The teachers were proactive in forming bonds with other teachers to assist them in gathering materials and other resources. These attributes of successful teachers are important to develop when forming a successful AC teacher education program (Ng & Thomas, 2007).

Other studies assessing differences in teaching practices of AC and TC teachers have used observational data. Miller, McKenna and McKenna (1998) found that there were no significant differences between two groups of third year middle school teachers in terms of components of observed lessons or in pupil-teacher interaction. Sindelar, Daunic and

Rennells (2004) also conducted a study involving observations of AC and TC teachers, but their focus was special education teachers' practices (grade level not provided) from one of three types of programs in Florida: traditional programs (four programs), university-district degree program partnerships (3 programs) and district add-on programs (3 programs). The researchers considered the latter two alternative routes to certification, but descriptions of the programs were not provided. While observing the AC teachers, the researchers used the Praxis-III to evaluate teachers' application of content and pedagogy knowledge. The study found that all teachers in the study met minimum teaching standards, but overall, teachers who completed a TC program had more formal knowledge of effective instruction.

However, teachers from the university-district partnership programs, considered an AC program, had a better understanding of school culture and climate. As indicated previously, this is likely a result of having been paraprofessionals within the schools (Sindelar et al., 2004). Based on results from these observational studies, little difference was found in the teaching practices of AC and TC teachers.

A third method of gaining insight into teaching practices of AC and TC teachers is through surveys of either the teachers, administrator or the teachers' students. In a Florida school district, Suell and Piotrowski (2006) conducted a study of first-year teachers (grade level not specified) either certified through traditional means or through the Florida Alternative Program. Using a Likert scale, the teachers completed a self-assessment of their level of competency in twelve areas including assessment, communication, continuous improvement, critical thinking, diversity, ethics, human development, knowledge of subject, learning environment, planning, role of the teacher and technological proficiency. The

results showed no significant differences in the teachers' self-assessment of their level of competency in any of the twelve areas (Suell & Piotrowski, 2006).

Owings et al. (2006) also conducted a study to gain insight into teaching practices of AC teachers involved in Troops to Teachers (T3), an AC program that prepares former military personnel to be teachers in high poverty schools. Using a national database of T3 teachers, researchers sent surveys to T3 teachers of all grade levels and disciplines to be completed by both teachers and their school administrators. The 5-point Likert scale survey instrument was adapted from Marzano's (2003) research that identified teachers' best practices associated with improving student achievement. Responses from both the teacher and administrator surveys indicated that the T3 teachers are effective. Among queries administrators were asked to rate included "This T3 Teacher Exhibits the Following Behavior to a Greater Degree than Other Teachers with Similar Years of Experience:" (Owings, et al., 2006, p. 119). While the researchers indicated that they were examining the effectiveness of T3 and TC teachers of similar years' experience, to do so would have involved administrators' assessment of both types of teachers and a comparison of results. However, administrators were not asked to assess the teaching practices of TC teachers so no comparison was possible.

Knight, Owens and Waxman (1990) used information gathered from the students to obtain their perception of their teachers' practices to determine if there was a difference in teaching practices between AC teachers and TC teachers. Participants were students of elementary and middle school teachers in districts that participated in the state's AC program. The students responded, with yes or no, to a valid and reliable instrument, *My*

Class Inventory, to determine their satisfaction in a number of areas: (a) class and school, (b) level of friction, cohesiveness, competitiveness and cooperation among students in the class, (c) difficulty level of work, (d) amount of low and high-level thought processes used in class, (e) pacing of class, and (f) parent involvement in class. Students of TC teachers expressed that more higher-level thought processes were used, the pacing was more appropriate, and reported more cooperation and cohesiveness in the classroom than their counterparts in classrooms of AC teachers (Knight, Owens, & Waxman, 1990).

As can be seen in research by Knight, Owens and Waxman (1990), Ng and Thomas (2007), Miller, McKenna and McKenna (1998), Owings et al. (2006), Sindelar, Daunic and Rennells (2004), and Suell and Piotrowski (2006), teaching practices are diverse among AC and TC teachers. According to observational research conclusions, it appears as if their teaching practices do not differ significantly. However, based on research involving student perception data of teachers' practices, there may be differences. The last method of assessing teacher effectiveness that will be explored is by examining student achievement.

Student Achievement

As teacher quality and accountability increase in importance, student achievement will continue to be more closely evaluated (NCLB, 2001). Thus, research on alternative certification has shifted focus from the demographics and teaching practices of individuals certified through AC programs and has begun to focus more on student achievement. Many studies utilized achievement test scores, some using only end-of-the-year data and others using gains in students' test scores. Depending on what data were available, some studies

specifically grouped teachers by certification route, others by certification program or by certification type. The following reviews such studies involving student achievement.

Among studies involving student achievement, Miller, McKenna and McKenna (1998) compared students' scores on the Iowa Test of Basic Skills to determine if difference existed in student achievement of students taught by fifth and sixth grade AC and TC teachers with three years of experience achievement in reading and mathematics. After collecting data on pretest scores and determining there was no initial difference between the AC and TC teachers' students and thus no need to account for a covariate, the researchers used a multivariate analysis of variance (MANOVA) in determining that there were no significant differences in student achievement (Miller et al., 1998).

A study conducted by the National Center for Education Evaluation and Regional Assistance (NCEE) and the U.S. Department of Education (2009) also found no significant differences in student achievement of AC and TC teachers. The researchers used pairs of novice (less than three years' experience) AC and TC teachers who were in the same schools and teaching at the same grade level between kindergarten and fifth grade. Researchers randomly assigned students to classrooms of AC and TC teachers, and analysis of student demographics and pre-test scores showed there were no preexisting significant differences in students of AC teachers and TC teachers. Using the California Achievement Test, 5th Edition (CAT-5), the researchers compared student achievement of TC and AC teachers finding that in both reading and mathematics there was no significant difference in student achievement of AC and TC teachers ($p=.12$ and $p=.84$, respectively). Additionally, this study categorized AC programs based on the amount of coursework required for completion

of the program. They used two levels: low-coursework (274 or fewer hours of instruction) and high-coursework (308 or more hours of instruction). Results indicated that the amount of coursework required of teachers did not impact student achievement (Constantine et al., 2009).

Boyd, Grossman, Lankford, Loeb and Wyckoff (2006) found similar results for teachers with three or more years' experience. This research compared standardized English and mathematics test score gains of New York City elementary and middle school students' of TC teachers with those of AC teachers. Boyd et al. (2006) divided the teachers into six categories. Two of the categories were essentially TC and the other four were various forms of AC programs or uncertified teachers. Because the researchers found that AC teachers taught classes with higher proportions of students that were minorities and students receiving free lunch, the model they used controlled for student demographics and school demographics to account for the difference in the two groups of students. The researchers examined gains in students' test scores over grades three through five and six through eight and found that after one year of teaching, gains in students' mathematics scores of three of the four types of AC teachers were slightly lower than gains in students' scores of TC teachers. One group of AC teachers, Teach for America (TFA) teachers, had similar levels of student achievement as the group of TC teachers did. However, the differences between the three types of AC teachers' and TC teachers' students' achievement did not exist after two or more years of teaching. The findings also revealed that gains in student achievement related to teacher experience were not significant after the teachers' third year of teaching. An additional finding was that in classrooms with a wide range of pre-test scores, the

students of TC teachers showed lower gains than students of AC teachers. Overall, Boyd et al. (2006) concluded that there are relatively small differences in student success when considering the teachers' pathway to certification, especially after the teachers' first year of experience (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006). This study is useful in analyzing gains in test scores for elementary and middle school students, but the effect of AC teachers on high school students was not addressed in this study. The current study focused on secondary school students and is designed to fill in this gap in the knowledge base.

Just as Boyd et al. (2006) focused on gains in students' test scores over multiple years, Darling-Hammond, Holtzman, Gatlin and Heilig (2005) did the same for students of grades three through five. This study also used standardized tests: the Texas Assessment of Academic Skills (TAAS), the Stanford Achievement Test (SAT-9), and the Aprenda. The researchers controlled for teaching experience and compared teachers who held a standard teaching certificate with those who did not, including AC teachers. In doing so, they found that students of teachers without standard certificates, including AC teachers, had lower gains in test scores than students of teachers with standard certificates. However, AC teachers had a positive effect on their students' success on the reading portion of the Aprenda, a test taken by Spanish-speaking students. Darling-Hammond et al. (2005) suggested that the AC programs attracted many Latino/Latina teachers who may be better able to support students taking the test (Darling-Hammond et al., 2005). Because Darling-Hammond's et al. study (2005) found that the AC teachers had a positive effect on students' performance on portions of the Aprenda, the current study analyzed student achievement of

minority students taught by AC teachers in secondary schools to see if they were more successful than TC teachers' minority students.

Other studies, such as those by Laczko-Kerr and Berliner (2002) and Goldhaber and Brewer (2000), used student achievement to detect differences between certified and uncertified teachers' effectiveness, rather than examining groups of teachers by certification route. For instance, Laczko-Kerr and Berliner's (2002) study involved third through eighth grade students' achievement on the Stanford Achievement Test in five Arizona school districts experiencing teacher shortages. Based on their certification status, teachers were either labeled as under-certified or certified. Under-certified teachers included those who had emergency or temporary certificates (had earned an undergraduate degree with no educational courses) or provisional certificates (had completed educational coursework but were missing certain requirements such as passing a licensure test). Teach for America (TFA), a common AC program, teachers were included in the under-certified group. The researchers matched under-certified teachers with certified teachers teaching the same grade and having the same highest degree earned. They also matched teachers in the same school when possible, or the same district, or within similar districts if necessary. Similar districts and similar schools were those with similar student to teacher ratios and administrator to teacher ratios (Laczko-Kerr & Berliner, 2002).

Using a correlated *t*-test, Laczko-Kerr and Berliner found that in the 1998-1999 and 1999-2000 school years, the students of certified teachers statistically significantly outperformed the students of under-certified teachers in the language and reading tests, but the difference in mathematics tests, while in the same direction as the former two tests, was

not significant. Because of departmentalization in seventh and eighth grades, where students have multiple teachers in the same year, the researchers analyzed test scores for only grades three through six and found that under-certified teachers' students' scores on all three tests in both academic years were significantly lower than certified teachers' students' scores (Laczko-Kerr & Berliner, 2002).

A second study that investigated the relationship between teacher certification status (e.g. standard, emergency, etc.) and students' achievement used data collected in the National Educational Longitudinal Study of 1988 (NELS:88). The researchers obtained a sample of 12th grade public school mathematics and science students who, in 8th, 10th and 12th grades, were surveyed to obtain demographic information and were also tested in the areas of mathematics, science, English/writing and history. Like Boyd et al. (2006), the researchers also found that teachers without standard teaching certificates have a higher proportion of students from lower socioeconomic backgrounds. Thus, any findings on the impact of teachers with non-standard teaching certificates are a lower bound for the true effect these teachers have on their students' success (Goldhaber & Brewer, 2000).

The NELS:88 classified teachers' certification status into five categories: (a) standard, (b) probationary, or beginning teachers who needed experience to receive a standard certificate, (c) emergency, or those who needed to complete additional coursework before receiving probationary or standard status, (d) private school certification, and (e) not certified, meaning the teacher was not certified in the subject area or did not hold any certificate for teaching. Teachers in the process of completing an AC program were likely classified as holding emergency certificates. Teachers, who completed a TC program, when

teaching in the subject area of certification, were either classified as standard or probationary. The researchers found that students of teachers who were either teaching in an uncertified subject area, or who held a private school certification, scored lower on the mathematics and science tests. However, students of teachers with emergency certification scored comparably on the mathematics test to students of teachers with standard teaching certificates (Goldhaber & Brewer, 2000).

Decker, Mayer and Glazerman (2004) also used student achievement to look for evidence that a particular AC program, Teach for America (TFA), had value for students' achievement in 1st through 5th grades. The research selected, as participating districts, a stratified sample of school districts that are classified as high-need or disadvantaged schools since these are the schools in which TFA most often places teachers. Students were randomly assigned to classrooms, and students' achievement was measured using fall and spring administering of the Iowa Test of Basic Skills (ITBS) (Decker, Mayer, & Glazerman, 2004).

Because the researchers were able to collect pre- and post-test scores, they were able to compare the growth rates of students in classrooms of TFA teachers and those in classrooms of teachers who had not been through a TFA program. Using students' percentile rankings, the researchers determined that in mathematics, students of TFA teachers significantly outperformed students in classrooms of non-TFA teachers. However, in reading, the increase from pre-test to post-test scores for TFA teachers' students and non-TFA teachers' students were similar. Because the first comparison did not take teachers' experience into account, further analysis only included non-TFA teachers with three or

fewer years of experience so as to compare teachers who had similar number of years of experience. Results indicated that students of TFA teachers still outperformed students of non-TFA teachers with three or fewer years of experience. Lastly, the researchers also compared the effects of TFA and non-TFA teachers on subgroups of students, and they found that by students' gender and ethnicities, the effects of TFA and non-TFA teachers were similar, but this cannot be generalized because of the small size of each subgroup (Decker et al., 2004).

Kane, Rockoff and Staiger (2007) also assessed the effectiveness of uncertified and AC certified teachers as compared to TC teachers. To conduct this study, they used 4th through 8th grade teachers in New York City, and obtained data sets from the New York City Department of Education concerning both teachers and their students. The data set included students' test scores and demographic information, and teachers' certification status and years of experience. The teachers' certification status was classified as one of four categories: (a) regular certified, (b) regular uncertified (which includes AC teachers), (c) teaching fellows, and (d) TFA. The researchers found no difference in student success in mathematics between teaching fellows and TC teachers and between uncertified and TC teachers. However, they found that TFA teachers' students outperformed TC teachers' students in mathematics. When accounting for experience, they found that first year TFA teachers', teaching fellows' and uncertified teachers' students do worse in mathematics than TC teachers' students. However, after three years of experience, the non-TC teachers outperform the TC teachers. Based on these findings, the researchers concluded that teachers who were classified as highly-qualified by No Child Left Behind (2001) were not

necessarily more effective than those who were not classified in that way (Kane, Rockoff, & Staiger, 2007).

The literature reviewed above provides examples of many studies that have assessed elementary and middle school students' achievement to gauge AC teachers' and TC teachers' effectiveness. Goldhaber and Brewer's (2000) examination of high school teacher certification and student achievement, however, was only able to classify teachers according to certification status, and not certification route. Thus, there is a gap in the existing research on student achievement in secondary schools in classrooms of TC teachers versus AC teachers, specifically in high school mathematics courses. There is also a lack of research examining AC and TC teachers' effects on student achievement by gender and by ethnicity. The current study analyzed student achievement of secondary school students of AC and TC teachers by students' gender and by ethnicity.

Among the current research available as described above, results varied. Some studies supported the claim that AC teachers are as effective as TC teachers, while others did not. The current study, which tested the following null hypotheses in order to gauge the effectiveness of secondary AC mathematics teachers, will make an important contribution to the literature base.

1. AC teachers' students' achievement on the mathematics portion of the MAP test will not differ significantly from TC teachers' students' achievement.
2. Performance on the mathematics portion of the MAP will not differ by gender for students' of AC teachers and TC teachers.

3. Performance on the mathematics portion of the MAP will not differ by race for students' of AC teachers and TC teachers.
4. There will not be an interaction between race and gender on mathematics MAP test scores of students taught by TC and AC teachers.

A method to measure student achievement is explained in the following section.

CHAPTER 3

METHODOLOGY

This study employed an observational (Rao, 1998) causal-comparative (Gall et al., 2007) design. This was an observational, or nonexperimental, study as the researcher was not able to determine levels of factors involved in the study and thus determined the levels through observation. “Causal-comparative research is a type of nonexperimental investigation in which researchers seek to identify cause-and-effect relationships by forming groups of individuals in whom the independent variable is present or absent...and then determining whether the group differs on the dependent variable” (Gall et al., 2007, p. 306). This nonexperimental study sought to identify differences in student success on the mathematics portion of Missouri’s state achievement test, the Missouri Assessment Program, (the dependent variable or response variable) between students taught by alternatively certified (AC) and traditionally certified (TC) teachers (independent variable or explanatory variable). Specifically, the study aimed to answer the following research questions.

1. Does the type of teacher certification (alternative or traditional) affect student achievement on the mathematics portion of the MAP test?
2. Does the type of teacher certification (alternative or traditional) impact mathematics MAP test scores by student gender differently?
3. Does the type of teacher certification (alternative or traditional) impact mathematics MAP test scores by student race differently?

4. Is there an interaction between student race and gender on mathematics MAP test scores of students taught by traditionally certified and alternatively certified teachers?

Since any observed differences in MAP scores could be attributed to a number of different variables impacting teacher effectiveness, one must be cautious in attributing differences in MAP scores solely to certification routes. In attempt to limit the variability in teacher effectiveness due to factors other than certification route, the researcher made efforts to select a group of TC teachers that was as similar as possible to the group of AC teachers. This included key characteristics such as age and number of years of experience. The researcher also attempted to have groups with similar gender and ethnicity proportions. A description of the participants and procedures follows.

Participants

Participants were recruited from two AC programs both offered by state universities. Program 1, is offered by an urban university in the Midwest, and Program 2 is offered by a regional university in a rural setting. Because of the small population of alternative certification (AC) mathematics teachers who were able to be contacted at the participating institutions, and thus the inability to conduct random sampling, convenience sampling was used in this study. One group of the participants in this study was comprised of in-service teachers enrolled in or graduates from either one of the institutions' AC programs. The AC teachers were all secondary school mathematics teachers who had at least one section of students who were either predominantly sophomore students or middle school students,

those who took the MAP test during the 2007-2008 school year. The researcher recruited all in-service teachers who, at the time of the study, were either enrolled in or had graduated from the AC programs who were teaching high school mathematics or middle school mathematics. From the list of 87 people who had been enrolled, at some point, in one of the two institutions' AC programs as mathematics teachers, the researcher attempted to contact all 53 AC program participants who had valid contact information. At least 26 of the 87 teachers did not teach a mathematics MAP tested course during the 2007-2008 school year. Three of the 87 agreed to participate in the study, but their school districts refused to participate in the study. Five of those verbally agreeing to participate in the study did not return consent forms to the researcher and were not involved in the study. School districts of two AC teachers who agreed to participate in the study did not respond to the researchers' requests to involve the district in the study. Of the participating schools, one was a charter school, and no participating schools had a mathematics or science focus. Table 1 provides the number of AC teachers in each program who were contacted and who agreed to participate in the program.

Table 1 Recruiting alternatively certified mathematics teachers

	<u>Program 1</u>	<u>Program 2</u>
Number of names provided to researcher	65	22
Number of teachers researcher attempted to contact ^a	37	16
Number agreeing to participate	11	7
Number involved in study	5	5

^a The researcher contacted all AC teachers for whom she had contact information.

The second group of participants was comprised of TC teachers. The researcher attempted to recruit a TC teacher for each participating AC teacher. Further, the researcher sought to include TC teachers who were in the same schools as the AC teachers and teaching the same courses as the AC teachers. For the ten AC teachers involved in the study, seven TC teachers participated. One of the schools involved in the study was a charter schools and had only one TC teacher who did not agree to participate in the study, and no other TC teachers were found at other area charter schools. Another school in the study only had two mathematics teachers, both of whom were alternatively certified, and the researcher was not able to find another TC teacher in another school in the district. In some schools, there was not a TC teacher teaching the same grade as an AC teacher. In these instances, the researcher recruited TC teachers in the same building but at different grade levels.

The researcher attempted to choose TC teachers who matched the AC teachers as closely as possible in the average number of years of experience, age, gender and ethnicity, but as mentioned above, TC teachers were most often selected on availability rather than on demographics. Table 2 provides information on the demographics of participating teachers; however the researcher did not have complete demographic information on one AC and two TC teachers.

Table 2 Demographics of participating teachers

Demographic	Alternatively Certified Teachers	Traditionally Certified Teachers
Number of participating teachers	10	7
Number of Males	5	1
Number of Females	5	5
Number White	8	5
Number Black	0	0
Number Asian/Pacific Islander	1	0
Mean Age	39.8	42.8
Median Age	34	42
Mean number of years teaching experience	3.8	13.4
Median number of years teaching experience	3	15.5
Mean number of years experience teaching MAP tested course	3.7	13.3
Median number of years experience teaching MAP tested course	3	15

Because of the relatively small number of teachers in each group (ten and seven), a non-parametric test, Wilcoxon rank-sum test, was used to determine if the differences in average age and number of years of experience were significant. For teachers for whom all demographic information was available, the ages of AC teachers ($Mdn = 34$) and of TC teachers ($Mdn = 42$) didn't seem to differ significantly ($W_s = 54, p > .05$). The number of years of teaching experience between the AC teachers ($Mdn = 3$) and the TC teachers ($Mdn = 15.5$) did appear to be significant ($W_s = 67.5, p < .05$). However, despite the fact that both the AC and the TC groups of teachers had relatively similar median number of year experience teaching MAP tested course as they had for overall teaching experience, the difference in the number of years teaching the MAP tested course was not significant ($W_s = 74, p > .05$). The results of these tests revealed the necessity of analyzing whether experience had a confounding effect before assessing the effects of certification route on student achievement (see Chapter 4).

Procedures

First, the researcher contacted each of the AC mathematics in-service teachers and graduates to request their participation in the study. If they agreed to participate in the study, they completed a demographics information form (Appendix A) and signed a letter of consent (Appendix B). The information form provided the researcher with personal and school related information including participant's school, school district, courses taught during the 2007-2008 school year, number of years of teaching experience, number of years

experience teaching each course, gender, age and race. Not all participants completed each section of the demographics information form resulting in missing data points.

Second, the researcher solicited permission from school district administrators to conduct the study. To accomplish this, the researcher informed the superintendents of the researcher's need to recruit teachers to participate in the study and to obtain students' demographic information and scores on achievement tests. If the superintendent agreed to participate, he/she signed a consent form (Appendix C) and a Data Compilation Form (Appendix D). The forms provided contact information for the person whom the researcher should contact to gather data. This process was time consuming. The researcher received Institutional Review Board approval to conduct the study in late October, 2008 and began recruiting AC teachers in late October. By late November, 2008 the researcher was able to begin contacting school districts. School district approvals were not received until December (1 district), February (1 district), April (3 districts) and May (2 districts). The researcher weekly called, e-mailed or faxed many districts who had not responded to previous contacts. As time passed, the contact became increasingly more frequent. Three districts decided not to participate in the study. Two of these districts did not provide reasons for declining to participate. A representative from the third district told the researcher that the district was cautious of the numerous requests for data districts were receiving of late. The district representative noted that the district was working to create a protocol to determine the priority of the numerous requests for data. In the meantime, they were denying all requests for data.

Once district permission was granted, the researcher's third step was to solicit the principals' permission as well. The principals were not required to sign a letter of consent since the superintendent had already done so, but permission from the principals helped build better relationships between the researcher and the schools than would have been possible had principals simply been informed that research would be conducted in the school. In many cases, the superintendents had already discussed the study with the principals to have their input in deciding whether or not the district would participate.

The researcher then contacted the participating AC teachers and their principals to recruit TC teachers to participate in the study. The original goal was to get a list of TC teachers and select one that matched the AC teacher in that school on as many characteristics as possible: teaching the same courses in the same school, same gender, age and years experience. However, the researcher found that in the schools where participating AC teachers work, there often were not multiple TC teachers from which to select a best match. Instead, there was often only one mathematics teacher who was traditionally certified. In some cases, the researcher contacted TC teachers recommended by the principal and AC teachers, but in other instances, the AC teacher or the principal talked with the TC teacher directly and had him/her sign the appropriate forms. Any teacher who agreed to participate completed the same information form and consent letter as the AC teachers.

The next step was data collection of student information. Based on the information the district provided the researcher on the Data Compilation Form (Appendix D), the researcher contacted a district employee (often principals or directors of technology) to initiate the data collection process. Some districts had a district employee compile the data

and provide it to the researcher. Other districts, as was approved by the Institutional Review Board, provided the researcher with access to the data, but student data were not linked to teachers. In these cases, the researcher used class rosters to create a data set void of all identifiable information. A list of variables for which data were collected is in Table 3. The variables fall into two main categories, student demographic information (gender and race) and student achievement. Data were collected on student achievement for two years where possible to provide a measure of students' earlier achievement, a quality of good research used by educational researchers (Walsh, 2001).

Table 3 *Student level explanatory and response variables*

Variable	Code	Description
StudentID	S_ID	These are IDs that do not allow the researcher to identify individual students but do allow the researcher to link variables.
Student Gender	S_GEN	Male or female
Student race	S_RACE	Race categories the state department of education uses are Asian/Pacific Islander, Indian, Black (not Hispanic), Hispanic and White.
08 MAP scale score	08_SCALE	Numeric score earned by the student
08 MAP achievement level	08_LEVEL	One of four levels (below basic, basic, proficient, advanced) based on the scale score
08 <i>Terra Nova</i> national percentile	08_TNNP	Calculated from the nationally normed <i>Terra Nova</i> Survey
Previous MAP scale score	PRE_SCALE	For sophomores during 2007-2008, this is a 2006 MAP scale score. For middle school students, this is a 2007 MAP scale score.
Previous MAP achievement level	PRE_LEVEL	For sophomores during 2007-2008, this is a 2006 MAP achievement level. For middle school students, this is a 2007 MAP achievement level.
Previous <i>Terra Nova</i> National Percentile	PRE_TNNP	For sophomores during 2007-2008, this is a 2006 <i>Terra Nova</i> national percentile. For middle school students, this is a 2007 <i>Terra Nova</i> national percentile.

Measures

In Missouri, through 2008, students took the mathematics MAP test in all grades 3-8 and also in grade 10. The MAP test is comprised of three sections: Terra Nova multiple-choice, constructed response and performance events. The Terra Nova is a nationally-normed test. Missouri educators (in-service teachers and college professors) wrote the constructed response and performance events items. In 2006 evidence of validity was checked by reviewers from Missouri as well as out-of-state teams. The reviewers included mathematics content experts, mathematics supervisors of various districts, mathematics educators, and mathematics education doctoral students. To check for evidence of the validity of the test using test content, the reviewers assigned at most three Grade Level Expectations (GLE) and one Depth of Knowledge (DOK) level (described below) to each item on the test.

The GLEs are specific objectives for the Missouri Standards. The standards are five broad content requirements specified for all grades: (a) Number and Operations, (b) Algebraic Relationships, (c) Geometric and Spatial Relationships, (d) Measurement, and (e) Data and Probability. Each standard is broken into goals or big ideas which are broken into concepts. Then each concept is articulated for various grade levels. See Figure 1 below for clarification.

The DOK levels are based on the level of reasoning necessary to answer the question. There are four DOK levels. The first is recall, and items in the first level ask students to recall facts, definitions and/or simple procedures. The second level is skill/concept, and items at this level involve more than one step. The second level items

require making a decision on how to solve the problem. The third level involves strategic thinking, and these items require more thought and higher levels of thinking than the first two levels. Such items often require students to explain their thought processes. The fourth level, extended thinking, requires complex reasoning that occurs over a period of time (Missouri Department of Elementary and Secondary Education, 2006). The fourth DOK level is designed to show vast student growth in thinking and reasoning through a unit of study lasting several weeks.

Figure 1 below shows a released item from the 2006 8th grade mathematics MAP test and the DOK level and GLE assigned to the item. The released item and the DOK levels and GLEs assigned to it provide the reader with an understanding of how these are connected and utilized in determining evidence of validity for the MAP test.

Figure 1 A Sample problem from the MAP with corresponding DOK and GLE.

“Joe has a sales job that pays him \$3,000 per month and he also earns 10% of his monthly sales as a commission. On the line below, write an expression that can be used to find Joe’s total earnings for a month. Let d represent his sales for the month, in dollars. One month Joe’s total sales were \$34,000. What was the amount of Joe’s earnings for that month?” (Missouri State Department of Elementary and Secondary Education, 2006, p. 5)

DOK level three: This example requires the student to write an expression which uses higher level thinking than DOK levels one and two.

GLE A3A.8: Standard: Algebraic Relationships; Goal: 3. Use mathematical models to represent and understand quantitative relationships; Concept: A. Use mathematical models; Grade level: 8. model and solve problems, using multiple representations such as graphs, tables, equations, or inequalities (Missouri Department of Elementary and Secondary Education, 2004, p. 11).

In 2007, to check for evidence of validity from the test content, the state department of education (DESE) compared the range-of-knowledge necessary for the Standards and the range-of-knowledge necessary for the MAP test. DESE then assessed the distribution of test questions for each of the Standards. The 2006 6th grade test met the requirements for alignment to the Standards in all areas. The 2007 6th grade test met the requirements for alignment in all but two areas: DOK consistency for Algebraic Relationships and balance of

representation in Geometric and Spatial Relationships were both weak. The 2006 7th grade test met the requirements for alignment to the standards in all areas except in the balance of representation in Numbers and Operations. The 2007 7th grade test was weak in four areas: DOK consistency, range of knowledge and balance of representation in Numbers and Operations and DOK consistency in Data and Probability. The 2006 8th grade test met requirements for alignment in all but two areas: DOK consistency for Numbers and Operations and balance of representation in Measurement. Similarly, the 2007 8th grade test met requirements for alignment in all but two areas: balance of representation in Algebraic Relationships and DOK consistency in Data and Probability. The 2006 10th grade tests also met requirements for alignment in all but two areas: DOK consistency in Numbers and Operations and balance of representation in Measurement. The 2007 10th grade test did not meet the requirements in DOK consistency in Numbers and Operations and Geometric and Spatial Relationships and did not meet the requirements for balance of representation in Numbers and Operations or Measurement (Missouri Department of Elementary and Secondary Education, 2006).

While the validity of the 6th through 10th grade MAP tests is not ideal, it is the state achievement test and was written using Missouri's Standards. It is definitely preferable to using a locally constructed test (Walsh, 2001), as tests for validity would not be feasible for the breadth and depth of this study. DESE released Technical Reports on the 2006, 2007 and 2008 tests addressing its construct-related validity using thorough tests of reliability, using internal consistency and convergent validity. The Cronbach's coefficient alphas (Missouri Department of Elementary and Secondary Education, 2006, 2007, 2008) are in Table 4.

Table 4 *Cronbach's Alpha to show reliability in MAP mathematics test over three-year span*

Grade	2006	2007	2008
Sixth	.92	.90	.92
Seventh	.92	.91	.92
Eighth	.92	.91	.93
Tenth	.94	.91	.94

The 2006, 2007 and 2008 tests all have evidence of reliability since all coefficients are equal to or greater than .90. It is also necessary to check for evidence of reliability for subgroups of students by gender and by race. These Cronbach's coefficient alphas (Missouri Department of Elementary and Secondary Education, 2006, 2007, 2008) are in Table 5, and all are above .90 except for the subgroups of Black in seventh grade in 2006 (.89) and Native American in sixth grade in 2006 and seventh grade in 2007 (.88 and .89, respectively) (CTB/McGraw-Hill, 2008a). The lower evidence of reliability for the Native American subgroup may be due to low sample sizes.

Table 5 Cronbach's Alpha to show reliability in mathematics by subgroup

Subgroup	Sixth Grade			Seventh Grade			Eighth Grade			Tenth Grade		
	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
White	.92	.91	.91	.92	.92	.91	.92	.93	.92	.93	.93	.93
Black	.91	.91	.91	.89	.91	.90	.90	.90	.90	.91	.91	.91
Hispanic	.91	.91	.90	.91	.91	.91	.92	.92	.92	.93	.93	.93
Asian/ Pacific Islander	.93	.92	.92	.93	.93	.94	.94	.94	.95	.95	.94	.95
Native American	.88	.91	.92	.92	.89	.92	.92	.93	.90	.93	.93	.93
Female	.92	.91	.91	.92	.92	.92	.92	.93	.92	.94	.93	.93
Male	.93	.92	.92	.93	.93	.93	.93	.94	.93	.94	.94	.94

CHAPTER 4

RESULTS

This study was designed to gain insight into the effectiveness of alternatively certified (AC) teachers from two AC programs as compared to the effectiveness of traditionally certified (TC) teachers. The researcher collected data on teacher and student demographics and on student achievement on Missouri's statewide achievement test, Missouri Assessment Program (MAP). Based on the classes taught by the participating 10 AC and 7 TC teachers during the 2007-2008 school year, data were collected on 667 students. The numbers of students by gender and race are in Table 6.

Table 6 Number of students by gender or race category for participating AC and TC teachers

	Alternatively Certified Teachers	Traditionally Certified Teachers
Males	192	144
Females	163	167
Asian/Pacific Islander	6	9
Indian	1	0
Black (not Hispanic)	141	80
Hispanic	35	34
White	171	187

While the numbers of students of most categories in Table 6 were similar for AC and TC teachers, there were two exceptions. The first was the number of male students the AC and TC teachers each had. None of the participating schools were all male schools, nor were any of the schools mathematics or science focused, both of which would have been possible explanation for the disproportionately higher number of males the AC teachers had in class. A potential reason for the discrepancy is the types of classes the AC and TC teachers taught. During the recruitment process, one principal commented that the AC teacher had mainly remedial classes, but the TC teacher had mainly classes of high performing students. It is possible that, in remedial classes, there were more at-risk male students than there were female students causing the number of male students for AC teachers to be higher than that of TC teachers.

Another discrepancy in number of students for AC and TC teachers is that AC teachers taught 141 Black (not Hispanic) students, and TC teachers taught 80 Black (not Hispanic) students. This is largely due in part to the fact that 84.6 percent of the minority students (not White) were from one district and one charter school. Of the students involved in these schools, 95.9% are minority students, and these schools account for seven of the 17 participating teachers. In the one large urban district participating in the study, four AC teachers participated, and only 2 TC teachers participate. Thus, the difference between the number of Black students taught by AC and TC teachers may be due to the fact that more AC teachers in urban settings participated than did TC teachers in urban settings. Additionally, for the ten participating teachers who were not in urban or charter schools,

only 11.9% of their students are not White. These percentages show that the schools involved in the study were either mainly comprised of minority students or white students.

In addition to demographic information, the researcher collected 2008 MAP data for each of the 667 students. In Missouri, students in grades three through eight and in grade ten take the mathematics portion of the MAP test, a statewide achievement test. Students' performance on the MAP test is reported as a scale score. In 2008, the scale scores for secondary grades ranged from 495-910 over 6th through 10th grades (CTB/McGraw-Hill, 2008b). The mean and standard deviation of these data for students of AC and TC teachers by students' gender and race are in Table 7.

Table 7 Mean and standard deviation of students' MAP scores by teachers' certification route

		Students' Gender		Students' Race				
		Male	Female	Asian/Pacific Islander	Indian	Black (not Hispanic)	Hispanic	White
Alternatively Certified Teachers	Mean	695.31	695.68	720.83	730	681.18	676.80	710.05
	Standard deviation	46.64	49.71	49.85	^a	50.48	34.16	43.69
	N	192	160	6	1	138	35	171
Traditionally Certified Teachers	Mean	689.41	688.75	690.44	^b	669.84	675.44	699.75
	Standard deviation	38.77	45.78	32.22	^b	47.27	33.14	39.12
	N	143	167	9	0	80	34	186

^a Standard deviation is not applicable since data on only one Indian student were available.

^b Data were not available on any Indian students.

Because students' success on the mathematics portion of the MAP achievement test may be affected by many factors other than teacher effectiveness, such as family, community and school factors (Rivkin et al., 2005), students' previous MAP scores were collected to help control for these factors, many of which would have been present the previous time the student took the MAP test. Because students in Missouri take the MAP test each year in grades three through eight and again in tenth grade, for students who were in sixth through eighth grade in 2008, their fifth through seventh grade MAP scores were recorded, respectively, and for students who were in tenth grade in 2008, their eighth grade scores were collected. However, previous MAP scores were not available for all students. Of the 667 students on whom data were collected, 302 did not include previous MAP score data, and 229 of these 302 students were from one district which was not able to provide previous MAP scores for any students. Other cases of previous MAP scores being unavailable are likely a result of students moving from another district, and thus the current district would not have the previous MAP scores on file.

To determine if the differences, shown in Table 7, in students' performance on the mathematics portion of the MAP test between students of AC and TC teachers are significant, the following hypotheses were tested:

1. Alternatively certified (AC) teachers' students' level of achievement on the mathematics portion of the MAP test will not differ significantly from traditionally certified (TC) teachers' students' level of achievement.
2. Performance on the mathematics portion of the MAP test will not differ significantly by gender for students' of AC teachers and TC teachers.

3. Performance on the mathematics portion of the MAP test will not differ significantly by race for students' of AC teachers and TC teachers.
4. There will not be a significant interaction between race and gender on mathematics MAP test scores of students taught by TC and AC teachers.

To test these hypotheses, the researcher employed a causal-comparative analysis.

Since research has shown that many variables contribute to a teacher's effectiveness (Boyd et al., 2006), cautious interpretation of the results is necessary. To limit the variability in teacher effectiveness due to factors other than certification route, the researcher selected a group of TC teachers that was as similar as possible to the group of AC teachers based on number of years of experience and age. The researcher also attempted to ensure that the gender and ethnicity proportions in the two groups were similar. However, because it was often not possible for the researcher to recruit a TC teacher who matched the participating AC teacher, as described in Chapter 3, the researcher conducted a preliminary analysis of the effects of teachers' experience on student achievement. Because many researchers have found that teachers' effectiveness increases during the first three years of teaching but has little effect beyond three years (Constantine et al., 2009; Decker et al., 2004; Kane et al., 2007; Miller et al., 1998; Rivkin et al., 2005), teachers were classified as either novice teachers (three or fewer years of experience) or experienced teachers (more than three years of experience), and this classification of experience was used as a fixed factor to determine if it impacted students' performance on the MAP test. Table 8 contains the mean mathematics MAP score for students of novice and experienced teachers. As previous research reported, as teachers' experience increased, their effectiveness increased as well,

but for the teachers participating in this study, novice teachers (those with three or fewer years of experience) had students whose mean 2008 MAP score was greater than that of experienced teachers (those with more than three years of experience), 703.09 and 691.46, respectively. This difference was found to be statistically significant $t(612) = 3.04, p=.003, p<.05$).

Table 8 *Student success on the mathematics MAP test by teachers' level of experience*

	Novice (three or fewer years of experience)	Experienced (more than three years of experience)
Mean	703.09	691.46
Standard deviation	43.87	45.90
N	213	401

Before conducting an ACOVA (Rao, 1998) test using previous MAP scores as a covariate to determine if teacher's experience teaching the MAP tested courses affects students' performance on the MAP test, it was necessary to test the assumptions. The observations were independent, and the response variable, students' MAP scores, was measured on at least an interval level. To test for normality of distributions between the two groups, novice and experienced teachers' students MAP scores, the researcher used a Kolmogorov-Smirnov test. The researcher found that distributions of MAP scores for novice teachers and experienced teachers were normal ($D(213)=.04, p=.20, p>.05$, and $D(401)=.04, p=.09, p>.05$, respectively). Next the researcher ensured that there was homogeneity of

variances using Levene's test ($F(1, 612)=.45, p=.50, p>.05$). Lastly, the researcher found homogeneity in the regression slopes ($p=.21, p>.05$). The results of the ACOVA test are in Table 9, and the results suggest that the teachers' level of experience did not affect students' 2008 MAP scores ($p=.53, p>.05$). However, previous MAP scores have a significant impact on current MAP scores ($p=.000, p<.05$) and have an effect size of .73, which reinforces the need to use previous MAP scores as a covariate.

Table 9 ACOVA results on mathematics MAP test with teachers' experience level as a fixed factor and previous MAP score as a covariate

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Eta Squared	Observed Power
Previous MAP score	457661.96	1	457661.96	949.03	.000*	.73	1.00
Course Experience	187.74	1	187.74	.39	.53	.001	.10
Error	172643.15	358	482.24				

R squared = .726 (Adjusted R Squared = .725)

* $p<.05$

Effects of Certification Route on MAP Scores

Next, after finding that the difference in experience level (novice or experienced) between the AC and TC teachers did not impact student success on the MAP test, the researcher used analysis of covariance (ACOVA) to compare student success of TC teachers

with that of AC teachers. The mean and standard deviation of 2008 MAP scores for students of AC and TC teachers are shown in Table 10.

Table 10 *Student performance on the mathematics MAP test by teachers' certification route*

	Alternatively Certified	Traditionally Certified
Mean	695.59	689.05
Standard deviation	47.96	42.62
N	353	310

The literature review in Chapter 2 included studies that had assessed the effectiveness of AC and TC teachers using student achievement. Some studies found that AC teachers and TC teachers were just as effective, while others found that AC teachers were less effective than TC teachers. The mean MAP scores shown in Table 10 reveal that for the teachers involved in this study, the AC teachers' students outperformed the TC teachers' students. However, it is first necessary to determine if this difference was a result of previous MAP scores, for those students for whom previous MAP scores were available, or if it appears to be a result of teachers' certification route. Additionally, because previous researchers have said that AC teachers often teach in districts in which many teachers find it difficult to teach, the students of AC and TC teachers did not necessarily have comparable previous levels of achievement in mathematics (Beach & Littleton, 1991; Feistritzer, 2007; Humphrey et al., 2008). To help control for this, the researcher involved a TC and an AC

teacher from each participating district in the study when possible; however, the researcher was not able to select teachers' courses to ensure that the two groups of students, those of AC teachers and those of TC teachers, were matched in academic success. For instance, at one school the AC teacher only taught mathematics courses often described as remedial courses, and the TC teacher did not teach any remedial courses. Thus, the students' previous performance on the MAP test was used as a covariate.

Analysis of covariance takes into account initial difference between the two groups of students (Gall et al., 2007) and reduces the within-group error variance (Field, 2005). The quantitative response variable is the 2008 MAP scores; the qualitative experimental factor is teacher certification route, and the quantitative confounding factor is the previous MAP scores (Rao, 1998). Because data on previous MAP scores were only available for 54.7% of students, these were the only students for whom the test applied. One large urban district participating in the study did not provide previous MAP scores, and this district accounted for 34.3% of the students for whom data were collected. Results of this test cannot be generalized to the whole sample or to the urban district involved in the study. The mean and standard deviation of 2008 MAP scores for the students for whom previous MAP scores were available by teachers' certification route are in Table 11, and the results still show AC teachers' students outperforming TC teachers' students.

Table 11 *Student success on the mathematics MAP test by teachers' certification route for only those students whose previous MAP score was available*

	Alternatively Certified	Traditionally Certified
Mean	709.78	694.68
Standard deviation	43.51	38.68
N	186	175

Again, before using ACOVA, it is important to test assumptions such as normal distribution of the population, homogeneity of variances, independent observations, measurement on at least an interval scale for response variable, and homogeneity of regression slopes (Field, 2005). Just as before, the observations were independent, and the response variable, MAP scores, was measured on an interval level. The researcher found that distributions of MAP scores for AC teachers and TC teachers were normal ($D(186)=.04$, $p=.20$, $p>.05$, and $D(175)=.06$, $p=.20$, $p>.05$, respectively). Next the researcher ensured that there was homogeneity of variances using Levene's test ($F(1, 359)=1.61$, $p=.21$, $p>.05$). However, the researcher did not find homogeneity of regression slopes ($p=.01$, $p<.05$), so the results of the ACOVA must be cautiously interpreted. This lack of homogeneity of regression slopes indicates that there is an interaction between students' previous MAP scores and their teacher's certification route. Corroborating the findings of lack of homogeneity of regression slopes, previous research has shown that AC teachers and TC teachers do not often have groups of students with similar records of previous academic

ability as AC teachers often fill vacancies in high-need schools (Beach & Littleton, 1991; Feistritzer, 2007; Humphrey et al., 2008).

The results of the ACOVA test in Table 12 suggest that under the correct model assumptions the teachers' certification route did significantly affect students' 2008 MAP scores ($p=.000$, $p<.05$) with an effect size of .05. However, as described above, all assumptions were not met with the available data.

Table 12 *ACOVA results on mathematics MAP test with teachers' certification route as a fixed factor and previous MAP score as a covariate*

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Eta Squared	Observed Power
Previous MAP Scale Score	446599.38	1	446599.38	975.02	.000*	.73	1.00
Certification Route	8852.60	1	8852.60	16.33	.000*	.05	.99
Error	163978.09	358	458.04				

* $p<.05$

The Effects of Certification Route on MAP Scores by Students' Gender

To answer the second research question about whether the effects of teachers' certification route differ for male and female students, the researcher also used ACOVA. Table 13 shows that both female and male students of AC teachers outperformed female and male students of TC teachers, respectively, but it was also necessary to test for significance

of the interaction between certification route and student gender using the students' previous MAP scores as covariates.

Table 13 *Student success on the mathematics MAP test by teachers' certification route and student gender for only those students whose previous MAP score was available*

	Alternatively Certified		Traditionally Certified	
	Male	Female	Male	Female
Mean	709.31	710.14	693.65	695.49
Standard deviation	40.34	48.15	40.06	37.75
N	109	76	77	98

Before performing an ANCOVA test, the researcher tested ANCOVA assumptions. The observations are independent, and the response variable, MAP scores, was also measured on at least an interval level. The Kolmogorov-Smirnov tests for normality in the distributions of MAP scores for both male and female students showed that the distributions were normal ($D(335)=.04, p=.20, p>.05$ and $D(327)=.04, p=.20, p>.05$, respectively). Levene's test for homogeneity of variances, while not significant, was not strong ($F(1, 660)=3.41, p=.06, p>.05$). The last assumption, homogeneity of regression slopes for student gender and previous MAP scores was not broken ($p=.30, p>.05$). The ANCOVA test produced the results in Table 14. The first result, found in testing the first null hypothesis, is that the main effect of certification route is significant ($F(1, 355)=16.83, p=.000, p<.05$) with an effect size of .05. However, there was not a significant effect on MAP scores from student gender or in

the interaction between certification route and student gender ($F(1, 355)=1.25, p=.27, p>.05$ and $F(1, 355)=.04, p=.84, p>.05$, respectively).

Table 14 ACOVA results for students' mathematics MAP test with teachers' certification route and students' gender as fixed factors and previous MAP score as covariate

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Eta Squared	Observed Power
Certification Route	7721.92	1	7721.92	16.83	.000*	.05	.98
Student Gender	572.42	1	572.42	1.25	.27	.004	.20
Previous MAP Score	446972.89	1	446972.89	974.44	.000*	.73	1.00
Certification Route * Student Gender	17.94	1	17.94	.04	.84	.000	.05
Error	162837.94	355	458.70				

R Squared = .742 (Adjusted R Squared = .739)

* $p<.05$

Effects of Certification Route on MAP Scores by Students' Minority Status

The third research question aimed to determine whether there are differences in teacher effectiveness by certification route for students of different races. Because of the small numbers of students within each non-white category as compared to the number of white students involved in the study (see Table 7), the researcher combined all students who were not white into one category with the label of minority. As previously noted, relatively

few minority students were in schools that were able to provide previous MAP scores, so in testing the third research question, previous MAP scores could not be used as a covariate. The mean and standard deviation of MAP scores for minority and white students of AC and TC teachers are in Table 15.

Table 15 Student success on the mathematics MAP test by teachers' certification route and student's minority status

	Alternatively Certified		Traditionally Certified	
	Minority	White	Minority	White
Mean	681.92	710.05	672.89	699.75
Standard deviation	48.07	43.69	42.93	39.12
N	180	171	123	186

For both AC and TC teachers, the minority students did not have scores as high as their white counterparts, but whether or not these differences were significant needed to be tested using ANOVA. The researcher first tested the necessary assumptions for ANOVA. The observations were still independent, and the response variable was the MAP scores which were measured on at least an interval level. The researcher found that distributions of MAP scores for minority students were normal ($D(303)=.04, p=.20, p>.05$). However, for white students, the distribution of MAP scores was not normal ($D(357)=.06, p=.01, p<.05$). In examining the histogram of MAP scores of white students, the researcher found that the distribution was leptokurtic (Field, 2005) showing that relatively few white students scored

in the two tails of the distribution or that that relatively few scored well above or below the mean. Next, using Levene’s test, the researcher ensured that there was homogeneity of variances between minority and white students’ MAP scores ($F(1, 658)=1.23, p=.27, p>.05$). Because there was no covariate, an ACOVA test could not be run; thus, no test for homogeneity of regression slopes was necessary.

After testing the assumptions, the researcher was able to run the ANOVA test, and the results are in Table 16. While the effect of students’ minority status on MAP scores was significant ($F(1, 656)=63.90, p=.000, p<.05$), the interaction between certification route and minority status was not ($F(1, 656)=.03, p=.85, p>.05$). Also, the effect size of students’ minority status is .09 while teachers’ certification route is .01 when not controlling for previous MAP scores.

Table 16 ANOVA results for students' mathematics MAP test with teachers' certification route and students' minority status as fixed factors

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Eta Squared	Observed Power
Certification Route	14987.60	1	14987.60	7.89	.01*	.01	.80
Minority	121362.17	1	121362.17	63.90	.000*	.09	1.00
Certification Route * Minority	64.36	1	64.36	.03	.85	.000	.05
Error	1245980.79	656	1899.36				

R Squared = .094 (Adjusted R Squared = .090)

* $p<.05$

Effects of Certification on Students MAP Scores by Gender and Minority Status

The last research question sought to determine if there was an interaction between students' gender and race when assessing the effects of certification route on students' MAP scores. The means for each group of students are in Table 17.

Table 17 Mean (and standard deviation) of MAP scores by teachers' certification route and students' gender and minority status

	Alternative Certification		Traditional Certification	
	Males	Females	Males	Females
Minority	683.44 (50.28)	680.40 (45.98)	679.33 (36.80)	666.13 (47.92)
White	706.11 (40.66)	715.33 (47.66)	697.47 (38.89)	701.44 (39.39)

While students of alternatively certified teachers outperformed students of traditionally certified teachers, whether or not the effects of the gender and minority interaction with certification route were significant was unknown. The researcher used ANOVA to determine the significance of the interaction. Before doing so, the assumptions were tested. The observations were independent, and the response variable, MAP scores, was measured on at least an interval level. As shown in the previous hypothesis tests, the distributions by gender and certification were normal and there was homogeneity of variances. Again, the results need to be interpreted with caution since the distribution of MAP scores for white students was not normal. The results of the ANOVA using MAP scores as the response variable and fixed factors of gender, minority and certification route

are in Table 18, and they reveal that the interaction between students' minority status, students' gender, and teachers' route to teacher certification did not have an effect on students' MAP scores ($F(1, 651)=1.32, p=.26, p>.05$).

Table 18 ANOVA results for students' mathematics MAP test with teachers' certification route and students' minority and gender as fixed factors

Source	Type III Sum of Squares	df	Mean square	F	Sig.	Partial Eta Squared	Observed Power
Certification Route	16561.09	1	16561.09	8.73	.003*	.01	1.00
Minority	122004.81	1	122004.81	64.29	.000*	.09	1.00
Student Gender	92.36	1	92.36	.05	.83	.000	.06
Certification Route * Minority*Student Gender	10037.86	4	2509.46	1.32	.26	.01	.42
Error	1235416.01	651	1897.72				

R Squared=.101 (Adjusted R Squared =.091)

* $p<.05$

Summary of Results

Four hypotheses were tested in this study to gain insight into the effectiveness of AC teachers as compared to TC teachers, and only the first null hypothesis was rejected. It stated that there would be no significant difference between student success on the mathematics portion of the MAP test for students of AC and TC teachers. However, the data revealed that

students of AC and TC teachers, respectively, with previous MAP scores available, had average mathematics MAP scores of 709.78 and 694.68. Additionally, teachers' certification route was found to have an impact on this difference ($p=.000$, $p<.05$). Also found to have a significant impact on mathematics MAP scores was students' minority status ($p=.000$, $p<.05$); however, the interaction between students' minority status and teachers' certification route, the third null hypothesis, was not significant. Nor were there significant interactions between students' gender and teachers' certification route, the second null hypothesis, or between students' gender, students' minority status and teachers' certification route, the last null hypothesis. The effect sizes showed that previous MAP scores accounted for the largest portion (73%) of the variance in student's current MAP scores while minority status accounted for nine percent and teachers' certification route accounted for five percent when controlling for previous MAP scores.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

Alternative certification (AC) programs have grown in quantity since their development in the 1980s, which has created more avenues for people to enter teaching without requiring them to leave the workforce (Feistritzer, 2007). Alternative certification programs were created to help relieve teacher shortages and to help improve teacher quality in the schools (AACTE, 1985; Brewer, 2003; Feistritzer, 2007). While AC programs have attempted to streamline processes for gaining certification, teacher education programs providing traditional routes to certification have attempted to improve teacher quality by increasing standards required for certification (Finn & Madigan, 2001). These two competing viewpoints aimed at improving teacher quality, streamlining certification with AC and increasing standards for TC programs, have led to debates among educational researchers about the effectiveness of each of these methods of attempting to improve teacher quality (Finn & Madigan, 2001). The focus of this study was specifically on the effectiveness of AC teachers as compared to TC teachers. Among the existing research on effectiveness of AC teachers and programs are those that sought to identify components of successful AC programs. The first component is that successful AC program participants have demonstrated high levels of either academic or work success. Second, an AC program participant must demonstrate having high content knowledge in his/her teaching area. The coursework in the AC programs is streamlined and/or tailored to the individual AC teacher's needs as a new teacher. Another important aspect of AC programs is frequent mentoring

provided by both the AC program and the schools in which the teacher teaches. Lastly, AC teachers are most successful when they have dispositions that match their cooperating schools and when the schools have strong leadership and necessary educational resources (Beach & Littleton, 1991; Humphrey et al., 2008; Walsh & Jacobs, 2007).

Two AC programs were used in this study, one in an urban setting where AC teachers mainly teach in urban and suburban schools and the other in a regional rural setting where AC teachers mainly teach in rural and suburban schools. The programs demonstrate components of successful AC programs in many areas. However, mentoring in the schools is not monitored by either program. Also, while required courses are neither streamlined nor tailored based on an AC teachers' past experience, they are adapted for each teacher based on the schools in which the teachers teach. In one program, assignments within courses are tailored for students specific to the schools in which the program participants teach, and the other program has two cohorts, rural and urban, depending on the type of school in which the AC teacher works. Lastly, the AC programs have limited control over which schools hire the AC teachers and thus cannot ensure necessary teaching resources or strong mentors and leadership in the school settings. Because these programs do not exactly match the descriptions of successful AC programs, and because the relationship between certification route and teacher effectiveness is hotly debated (Darling-Hammond et al., 2005), this study aimed to determine if mathematics teachers certified through one of these two specific AC programs are as successful as TC mathematics teachers in the same school districts. A brief summary of the review of previously completed research on the effectiveness of AC teachers and the methodology of the current study follows.

Review of Literature

Researchers have used various measures to gauge the effectiveness of teachers: teacher preparedness, teaching practices and student achievement. While teacher preparedness and teaching practices are important ways to measure teacher effectiveness are significant, student achievement is more relevant with the increase in state and national school and teacher accountability measures. Several studies have used student achievement to look for differences in the effectiveness of AC and TC teachers, and the results and methodologies have been mixed. For instance, two studies classified teachers as either AC or TC and found that their students' performance was not significantly different (Constantine et al., 2009; Miller et al., 1998). However, a third study found that for many AC teachers, their student achievement was lower than TC teachers' students after one year of teaching. After two or more years of teaching, however, the students' performance was not statistically different (Boyd et al., 2006).

Other studies did not classify teachers by certification route but rather by whether or not the teachers held a certificate or what type of certificate they did hold. Three studies classified teachers as either certified teachers or noncertified teachers. Two of these studies found that noncertified teachers' students performed at lower levels than students of certified teachers (Darling-Hammond et al., 2005; Laczko-Kerr & Berliner, 2002). However, one of these studies found an exception for Latino/Latina students of uncertified teachers who outperformed Latino/Latina teachers of certified teachers (Darling-Hammond et al., 2005). Another exception for a subgroup of student achievement scores was in mathematics. Achievement scores for third through eighth grade students of both certified teachers and

noncertified teachers did not differ significantly (Laczko-Kerr & Berliner, 2002); however, this study did not involve high school teachers specialized in mathematics as the current study did. The third study, classifying twelfth grade students by whether or not their teacher held teaching certificates, found that those holding emergency certificates had students who, in mathematics, did not perform significantly differently than students of teachers holding standard certificates (Goldhaber & Brewer, 2000). Unlike Goldhaber and Brewer's (2000) study, the current study classified teachers by certification route, alternative or traditional, rather than the type of certificate each teacher held. To summarize, the previous research has either found that AC teachers' and uncertified teachers' students perform as well as or at lower levels than TC teachers' and certified teachers' students do. In none of these above studies did the results show AC teachers' students outperforming TC teachers' students.

Researchers have also conducted studies on student achievement of Teach for America (TFA) teachers, a type of AC program, and these results have differed from the results of studies from other types of AC programs. They have found that TFA teachers' students achieve at higher levels than TC teachers' students. One found that student achievement in mathematics was better for TFA teachers than teachers who had been certified through some route other than TFA (Decker et al., 2004). The other study found that after three years of experience, TFA teachers' students outperformed TC teachers' students; however uncertified teachers' (which did not include the TFA teachers) students' achievement did not differ significantly from TC teachers' students (Kane et al., 2007).

While researchers have conducted studies examining teacher effectiveness for teachers certified through AC programs, few have examined student achievement at the

secondary school level. Most of the aforementioned studies only examined student success in elementary and middle schools and have not included high school students, with the exception of Goldhaber and Brewer (2000). Because elementary teachers do not teach just one subject area, many of the above studies did not focus on one specific content area. While many of the studies mentioned above examined student success on different subject area portions of achievement tests, mainly reading and mathematics, the AC teachers involved were not always specialized in mathematics as they are in the current study. Additionally, few of the studies disaggregated the data by gender and race to evaluate whether or not there were differences in student achievement by gender and race. The current study sought to fill these gaps in the research with the following research questions:

1. Does the type of teacher certification (alternative or traditional) affect student achievement on the mathematics portion of the MAP test?
2. Does the type of teacher certification (alternative or traditional) impact mathematics MAP test scores by gender differently?
3. Does the type of teacher certification (alternative or traditional) impact mathematics MAP test scores by race differently?
4. Is there an interaction between race and gender on mathematics MAP test scores of students taught by traditionally certified and alternatively certified teachers?

The results of previous studies were mixed. Because some found AC teachers' (primarily TFA teachers') students had higher levels of achievement and some found TC teachers' students had higher levels of achievement, the following null hypotheses were used:

1. AC teachers' students' achievement on the mathematics portion of the MAP test will not differ significantly from TC teachers' students' achievement.
2. Performance on the mathematics portion of the MAP will not differ by gender for students' of AC teachers and TC teachers.
3. Performance on the mathematics portion of the MAP will not differ by race for students' of AC teachers and TC teachers.
4. There will not be an interaction between race and gender on mathematics MAP test scores of students taught by TC and AC teachers.

Methodology

To test the hypotheses above, the researcher utilized the following procedures. While the researcher attempted to involve as many AC mathematics teachers in the study as possible, only ten AC teachers actually participated. There were various reasons given for not participating. First, contacting the AC teachers whose names were provided by the two participating programs, proved to be more difficult than expected. Of the original 87 names the two AC programs provided to the researcher, only 53 were accompanied by contact information, and not all of those had current contact information. Twenty-six of the AC teachers the researcher contacted did not teach any courses with students who took the mathematics MAP test during 2007-2008. For teachers who did not respond or who did not have current contact information on file with the AC program, the researcher searched online directories of all area schools and the state's department of education webpage in attempts to determine where some of the AC teachers on the list were teaching. The

researcher also asked all AC teachers who were able to be contacted if they had contact information for any other AC mathematics teachers in their program.

Of the AC mathematics teachers who were able to be contacted, the ones agreeing to participate signed a consent form (Appendix B) and completed a form (Appendix A) providing demographic information and the classes he/she taught in the 2007-2008 academic year. Despite the efforts to recruit as many AC teachers as possible, only 15 AC teachers signed consent forms. Five others verbally agreed to participate but never returned their forms despite multiple phone and e-mail requests from the researcher.

One likely reason for AC teachers avoiding participation was for lack of understanding of the research study and the minimal time required for participation in the study. The paperwork provided to the AC teachers during recruitment was three pages long. Two of the pages were the consent letter, and the third was the information form to be completed by participating teachers. Teachers are very busy, and classroom needs were likely more pressing than reading the consent information and completing the demographic information form. Therefore, not all teachers read the information or realized that participation in the study did not require any more time than what was required to complete the information form. This lack of understanding of time requirements for participation in the study was verified for one AC mathematics teacher in Program 1. The researcher's advisor met with this AC teacher for reasons other than the research study and asked if she was interested in participating. She said that she did not have time to do so. After the advisor explained that participation only required signing a consent form and filling out an information form, the AC teacher was embarrassed to not have helped out months before.

However, even after verbally agreeing to the advisor to participate, the form was never signed and sent to the researcher. This anecdote provides insight into how other AC teachers might have perceived the study and thus why relatively few AC teachers ended up agreeing to participate despite the relatively minor time commitments incumbent with study participation.

For the fifteen AC mathematics teachers who signed consent forms and completed demographic information forms, the researcher contacted the superintendents at the corresponding 11 districts to request school districts' approval to collect data. If the district approved, the superintendent or the superintendent's designee signed a consent form (Appendix C) and provided the researcher with information on who would be compiling data. In six of the districts the researcher contacted, she was eventually able to speak directly with the superintendent. At other districts, the researcher was only able to contact the superintendent's secretary or a superintendent's designee to address the research proposal. For the districts where a deputy superintendent chose whether or not to participate, the researcher needed to change the verbiage on the consent forms from "superintendent" to "superintendent or superintendent's designee," and the change was approved by the Institutional Review Board. This allowed for more timely responses from districts where the superintendent delegated these responsibilities to deputy superintendents.

Responses to requests for district participation varied. One district responded that they were not going to agree to participate in the study because of the multitude of requests for research they received each year. Administrators in the district had agreed that they needed to write a protocol to use in determining which studies would be allowed in the

schools, and in the meantime, they were denying all requests for data. Another school only replied with a fax that said they did not want to participate. At one school, after three months of the researcher talking with the superintendent's secretary who said she had talked with the superintendent about the study in various meetings, the secretary said that unless the researcher heard otherwise, the school district was not going to participate. At another school, after four months of leaving biweekly messages for the superintendent, the researcher called the principal who agreed to meet with the superintendent to discuss the study. After another two months of leaving biweekly messages for the principal, the researcher understood the lack of signed consent forms to be a passive form of declining to participate in the study. A fifth district, after agreeing to participate and after sending the researcher the signed district consent forms, told the researcher that the AC teacher did not teach students who were MAP tested in mathematics during the 2007-2008 school year. This information conflicted with what the teacher had provided the researcher in the study participation recruitment process, but the AC teacher was removed from the study nonetheless. Though 15 AC teachers agreed to participate, after requesting school districts' approval to participate in the study, only ten AC mathematics teachers were included in the study.

After districts agreed to participate in the study, the researcher received Institutional Review Board (IRB) approval to proceed with the study and collect data from the participating districts. For the remaining ten participating AC mathematics teachers, the researcher attempted to recruit TC teachers from the participating schools who taught the same courses, had similar years of teaching experience, and were of the same race and

gender and similar age. To do so, the researcher contacted the principal in the school, the superintendent of the district or the participating AC teacher to request names of TC teachers in the school. In one school, there was one other mathematics teacher, but he opted not to participate in the study, claiming that MAP scores are not a good indicator of a teacher's effectiveness. In no districts was the researcher able to choose from a list of TC teachers to ensure that AC and TC teachers matched on the above criteria. In some schools this was because there were only one or two other mathematics teachers. In other schools it was because there were few TC mathematics teachers. A conclusion the researcher drew from the experience of recruiting TC teachers is that few schools that hire AC mathematics teachers have TC mathematics teachers as well. One school that participated would be considered suburban, and the others were either rural or urban. Thus, the schools with the highest needs, urban and rural schools, infrequently employ TC mathematics teachers, and AC programs are providing a much needed service to these schools.

Eventually, seven TC mathematics teachers agreed to participate in the study, and the researcher collected data on the seventeen participating teachers. In some districts, a district employee was designated to compile the data and remove students' identifying information. In other districts, the district provided the researcher access to the data, and the researcher compiled the data and removed students' identifying information, as specified in the permission granted with the Institutional Review Board. One of the districts that designated someone to compile data, the one district with multiple participating AC mathematics teachers, did not provide the researcher with all requested data. This was an urban district with a high population of minority students. Thus, for most minority students

in the study, previous MAP scores were not available, and this affected how the researcher was able to analyze data for all students. From these data, the following results were found.

Results

In comparing the means of mathematics MAP scale scores between students of AC and TC mathematics teachers, the mean scale score of students of AC teachers is higher than that of TC teachers. For students for whom previous MAP scale scores were available, previous MAP scale scores were the biggest predictor of performance on the 2008 MAP scale score with an effect size of .73. Previous MAP scale scores by far accounted for the largest portion of variance in students' 2008 MAP scores, 73%. While the impact of teachers' certification route was also significant ($p < .001$), the effect size was .05 indicating that teachers' certification route contributed to five percent of the variance of the students' MAP scores. These results are supported by studies that focused on Teach for America (TFA) and were conducted by Decker et al. (2004) and Kane et al. (2007). The results also augment the literature that supports the fact that AC teachers do not have differing effects from those of TC teachers (Boyd et al., 2006; Constantine et al., 2009; Goldhaber & Brewer, 2000; Miller et al., 1998).

Perhaps one reason the results of the current study differ from previous studies' results is that many of the previous studies did not focus on mathematics secondary teachers as the current study did. Many studies cited in this study used elementary teachers, and some used middle school teachers. One study in particular found that third through eighth grade under-certified (including those going through an AC program at the time of data collection)

and certified teachers' students' success on the mathematics portion of an achievement test did not differ significantly; however, in only looking at third through sixth grade students, the under-certified teachers' students did not perform as well as the certified teachers' students (Laczko-Kerr & Berliner, 2002). This study did not include high school students, and the results that found that under-certified teachers' students performed at lower levels than certified teachers' students, did not address secondary school students at all.

Another reason that comparing AC and TC teachers at the secondary level in the area of mathematics might be different than comparing those at the elementary level might be because of teachers having a major or minor in the content area. In the two AC programs used in this study, AC teachers must have a bachelor's degree in mathematics or a related field in order to participate. This would corroborate previous findings that teachers having a major or minor in the content area in which they teach have students who outperform students of teachers who do not have a major or minor in the content area (Goldhaber & Brewer, 2000; Wenglinsky, 2002). However, this is not to say that the TC teachers in the study did not have majors in mathematics as the AC teacher did. It just suggests that perhaps the reason the AC teachers' students outperformed TC teachers' students on the mathematics test unlike the AC and TC teachers in other studies, is because this study focused solely on secondary mathematics teachers who had majors or minors in mathematics, and other studies focused on elementary and middle school teachers and not on a specific content area.

Unlike studies which found that as teacher experience increased during the first three years, teachers became more effective (Constantine et al., 2009; Decker et al., 2004; Kane et

al., 2007; Miller et al., 1998; Rivkin et al., 2005), the current study found that novice teachers (those with three or fewer years of experience) had students with significantly higher MAP scores than experienced teachers (those with more than three years of experience). However, the difference in average MAP scores between novice and experienced teachers' students was found to not be an effect of teachers' experience level when controlling for students' previous performance on the MAP test. Teaching experience relates to teachers' certification route in that the AC teachers had, on average, 3.8 years of experience while TC teachers had, on average, 13.4 years of experience. If anything, this should have biased the results in favor of the TC teachers; however there was no way to control for potential factors such as teacher burnout that might have been more prevalent with teachers with more experience. The facts that the novice teachers' students had an average MAP score greater than that of the experienced teachers and that this was not attributable to the teachers' number of years of experience may instead be an effect of certification route, which was found to have a statistically significant impact on students' MAP scores.

The study aimed to determine if teachers' certification route impacted male and female students differently. In testing for an interaction between teachers' certification route and students' gender, the results revealed that neither student gender nor the interaction between student gender and teachers' certification route were significant ($p=.27$ and $p=.84$, respectively). However, the impact of teacher's certification route was still significant with an effect size of .05, indicating that teachers' certification route accounted for five percent of

the variance of students' MAP scores. However, students' previous MAP scores still had the largest effect size of .73.

In order to assess the effects of students' minority status on students' mathematics MAP scores, previous MAP scores could not be used as a covariate. This is because for most of the minority students, previous MAP scores were not made available to the researcher. When not controlling for students' previous MAP scores, the effects of certification route were still significant ($p=.01$) but not as strong, with an effect size of .01 indicating that teachers' certification route accounted for one percent of the variance of students' MAP scores. However, when students were classified according to race, white or minority (not white), the impact of minority status was significant and was greater than the impact of certification route (effect sizes of .09 and .01, respectively). The impact of minority status was nine times that of certification route. However, the interaction of certification route and minority status was not significant ($p=.85$). Similarly, the interaction between teachers' certification route, students' gender, and students' minority status was not significant ($p=.26$).

Limitations

Various limitations affected the methodology and results of the study. First, the results of this study cannot be generalized to other regions, programs or states as this study only focused on two programs in Missouri. Also, because teachers decided whether or not to participate, there is inherently participation bias. It is possible that teachers who feel their students performed well on the test would agree to be involved in the study whereas teachers

whose students did not perform as well on the test might be more likely to decline to participate. The size of the sample of teachers was a limiting factor in this study. Although including many more AC teachers in the study would have been preferable, it was not possible due to the lack of current contact information regarding the teachers who completed the AC programs. Additionally, the study design intended to match a TC mathematics teacher for each AC mathematics teacher involved in the study, but only seven TC teachers were willing to participate. The small number of AC teachers combined with the inability to pair TC teachers with each of the AC teachers is a limiting factor.

Another aspect of recruiting TC teachers that was a limiting factor related to the types of schools where TC and AC teachers commonly work. Few TC mathematics teachers taught in schools where AC mathematics teachers taught, so it was not possible to choose TC teachers who matched the AC teachers on courses taught, gender, race, age and years of teaching experience as was originally the intent of the study. In fact, the average years of teaching experience between the group of AC and TC teachers was significantly different (3.8 and 13.4, respectively).

In terms of data collection, one limitation was the fact that the large urban district involved in the study did not provide students' previous MAP scores. Thus, for the large percentage of minority students involved in the study, previous MAP scores could not be used as a covariate. This proved to be a limiting factor when considering the strong effect size of previous MAP scores on other students' current MAP scores.

Other factors were limitations in this study but were not due to research methodology or recruitment difficulties. For instance, many factors contribute to teachers' effectiveness,

and differences in MAP scores between the two groups cannot be assumed to be solely attributable to teachers' certification route. Additionally, since only mathematics teachers were involved in this study, the results cannot be generalized to other subject areas. Another limitation is high school students have multiple teachers each year. Thus, the students' mathematics teachers' route to certification is not the only factor affecting student achievement on the mathematics MAP test. Another fact that could not be controlled was whether or not the participating teachers had student teachers in their classrooms during the MAP tested years. The results would not necessarily be indicative of the participating teachers' instruction if another adult was providing all or a substantial portion of instruction.

Because of the lack of strong evidence of the validity of the MAP test for each subgroup of students, the scores might provide another limitation in this study. Also, as with many state achievement tests, students are not held accountable for their achievement on the MAP test. Students are not sanctioned for poor effort or performance on the MAP test, so some students might not have performed at their best level when taking the test.

In terms of the nature of AC programs, there are sources of potential limitations. Because variation in AC programs is vast, results cannot be generalized to all AC programs (Boyd et al., 2007). Similarly, many AC programs' components are similar to TC programs' components so differences in teachers' effectiveness may not exist because the teachers actually receive similar training (Walsh & Jacobs, 2007).

Suggestions for Future Research

These limiting factors do not make the research less valuable. The results contribute to the body of knowledge and can influence future research. For instance, because of the large effect size of previous mathematics MAP scores, future research should consider collecting previous test scores to use as covariates. Given that some achievement tests are very strongly correlated to one another, it may be beneficial for future researchers to consider utilizing other achievement knowledge examinations as covariates as well. Additionally, results of student performance on the MAP test are reported in the form of scale scores and in achievement level, based on the scale score. The current study assessed the impact of certification route on mathematics MAP scale scores for secondary students but did not utilize achievement levels. Impact of teachers' certification route on students' achievement level on the MAP test would provide results that would augment the results found using MAP scale scores. In conjunction with the MAP test, students also take a *TerraNova* test, and national percentiles are reported from these tests. Students' success on the *TerraNova* test by teachers' certification route can be analyzed as well.

Additionally, involving AC teachers certified through various AC programs of similar structure to the two AC programs involved in this study would aid in providing results that could be more generalizable to other AC programs of similar structure. Also, if a researcher could involve more AC teachers from participating AC programs, the larger sample could provide more power to the statistical tests. In terms of involving TC teachers, if they could be matched to the AC teachers on courses taught, experience and teaching settings (Humphrey & Wechsler, 2007), the findings could more directly enhance the body

of existing research on effectiveness of AC teachers in comparison to TC teachers more directly.

While the current study was a quantitative study, it has provided opportunities for future qualitative or mixed-methods research. For instance, a study of the reasons the participating AC and TC mathematics teachers entered the teaching workforce, and the dispositions of each participating teacher would be beneficial to the knowledge base by providing insight into why the AC mathematics teachers were more effective than the TC mathematics teachers. The fact that the participating AC teachers had, on average, fewer years of experience and more often taught more remedial courses, with students who had previously struggled in mathematics, than the TC teachers did should suggest that the AC teachers had students who did not perform as well as the AC teachers' students. The results of this study showed that, in fact, the opposite occurred, and the AC teachers' students outperformed the TC teachers' students. Based on this finding, the researcher concluded that there are compelling reasons to determine why the AC mathematics teachers are more effective than their TC counterparts despite numerous obstacles.

Conclusions

This research study has provided significant findings that give insight into the effectiveness of AC mathematics teachers as compared to TC mathematics teachers. Teachers' certification route, students' previous MAP scores, and students' minority status were determined to be significant factors in determining students' success on the mathematics portion of the MAP test. In fact, the AC mathematics teachers involved in this

study had students who earned mathematics MAP scores higher than that of their TC teacher counterparts. Based on findings from this study, in general AC teachers who taught mathematics and who were trained by one of the participating AC programs did a somewhat better job of preparing their students for the mathematics MAP test as indicated by the higher MAP scale scores of the AC teachers' students as compared to the TC teachers' students.

This provides support for the effectiveness of area AC mathematics programs. While the results of the study cannot be generalized to specific AC teachers involved in the programs or to AC programs in other locations, they still provide positive news for area districts that rely on hiring AC teachers to help resolve shortages of highly qualified mathematics teachers. The results of this study suggest that secondary AC mathematics teachers involved in the two participating programs do not impede student success on the mathematics portion of the MAP test. Students of the AC teachers were not at a disadvantage as compared to the students of participating TC teachers. Because the two participating AC programs provide a means to certification for teachers who serve urban and charter schools with few TC teachers, the AC programs are providing a valuable service to the local districts.

APPENDIXES
APPENDIX A

TEACHER INFORMATION FORM (AC)
Research on Alternative Certification in Mathematics

Name _____

School _____

School District _____

School Address _____

City _____ State _____ Zip _____

Home Address _____

City _____ State _____ Zip _____

Phone Numbers and E-mail *Please check your preferred phone number and e-mail address.*

Phone Number: Home _____ School _____

E-mail Home _____ School _____

Demographic Information:

Route to teacher certification

Traditional Certification (4-year undergraduate degree with student teaching)

Alternative Certification *What institution issued the certification?* _____

Other *Please explain* _____

Date of full certification (or expected date of full certification) _____

Age __ Gender __ Ethnicity __ Number of years teaching math (through 2007-2008) __

Information on Classes Taught:

In the table below, please provide the courses you taught during 2007-2008 in which the majority of the students were MAP tested in mathematics. Include class names, the hour you had the class, the approximate number of students in each class, the school and school district in which you taught the class, the grade level of most students taking the course, and the number of years experience you have (through 2007-2008) teaching this course.

Course	Period (1 st hour, 2 nd hour, etc.)	Approximate Class Size	Academic Year	School and School District	Grade level of students in course	Number of years teaching course

APPENDIX B

Consent for Participation in a Research Study

Alternative Certification

Jennifer J. Wall

Dear ****Insert Name ****,

You are invited to participate in a research study involving alternative certification teacher candidates at Program 1 and Program 2 in the area of mathematics. The researcher would like to have 25 mathematics teachers who are alternatively certified, and another 25 traditionally certified teachers involved in the study.

Because of the highly debated issue of the effectiveness of Alternative Certification programs, the researcher is conducting a study to gain insight into the effectiveness of the participating programs. To study the effectiveness, the researcher will compare mathematics MAP scores of students of a group of alternatively certified teachers and a group of traditionally certified secondary mathematics teachers. The two groups of teachers will have similar number of years of experience teaching. The two groups will include similar numbers of teachers at each grade level being studied.

If you decide to participate, you will complete the attached Teacher Information Form. It should take no longer than thirty (30) minutes to complete the form. This Teacher Information Form will provide the researcher demographic information and information on the classes that you have taught over the past few years. The researcher will then contact your superintendent and principal to request permission to use school data in the research study. All student level data will be collected through the school district.

Participation in this study is voluntary at all times. You may choose to not participate or to withdraw your participation at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which you are entitled.

If you decide to leave the study, the information you have already provided in the form of the Teacher Information Sheet will be destroyed.

The researchers will take extreme caution to maintain the confidentiality of each person involved in this study. While every effort will be made to keep confidential all of the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions. All MAP scores will remain confidential, and names and school

districts will not be used in the researchers' writings. This will avoid risking social, physical and psychological harm to you.

There are no known risks to you as a participant in this study. The benefit is that there is potentially great value to society in continuing Alternative Certification programs at various institutions in putting additional qualified teachers in the classroom.

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about the study that you are participating in, you are encouraged to call Jennifer Wall, the investigator, at (phone number provided).

Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been injured as a result of participating in this study, please call the IRB Administrator of UMKC's Social Sciences Institutional Review Board at (phone number provided).

Thank you for your time,

Jennifer Wall
Ph.D. Student
University of Missouri – Kansas City
(contact information provided)

Participant's Name (please print) _____

Participant's Signature _____ date _____

Investigator's Name (please print) _____

Investigator's Signature _____ date _____

APPENDIX C

School District Consent for Participation in a Research Study

Alternative Certification

Jennifer J. Wall

Dear ****Insert Name ****,

Your school district is invited to participate in a research study involving alternative certification teacher candidates at Program 1 and Program 2 in the area of mathematics. The researcher would like to have 25 mathematics teachers who are alternatively certified, and another 25 traditionally certified teachers involved in the study.

Because of the highly debated issue of the effectiveness of Alternative Certification programs, the researcher is conducting a study to gain insight into the effectiveness of the participating programs. To study the effectiveness, the researcher will compare mathematics MAP scores of students of a group of alternatively certified teachers and a group of traditionally certified secondary mathematics teachers. The two groups of teachers will have similar number of years of experience teaching. The two groups will include similar numbers of teachers at each grade level being studied.

The researcher has recruited a group of alternatively certified secondary mathematics teachers. A list of these teachers either currently teaching or who taught in your school in 2007-2008 is attached. Each of these teachers has agreed to participate in the study if you allow the school district to participate in the study.

If you do decide to allow the school district to participate in the study, the researcher will contact the principals in the schools in which the attached list of teachers either currently teach or taught during 2007-2008. The principals will refer the researcher to traditionally certified teachers who are teaching the same subjects as the alternatively certified teachers. If the traditionally certified teachers also agree to participate in the study, the researcher will collect demographic information and mathematics MAP scores of students of both groups of teachers. A list of variables to be collected is attached.

If possible, to maintain student anonymity, the students' demographic information and mathematics MAP scores will be compiled by someone within the school district. Either you or the teachers' principals will designate someone to compile the data and make it available to the researcher with all student names removed. You will inform the researcher of who to contact regarding data collection on the attached Data Compilation Information Form. If it is not possible for anyone within the district to compile the data, the district may allow the researcher to do so. In these cases, the data will not be anonymous, but the researcher will keep all data confidential.

Participation in this study is voluntary at all times. You may choose to not participate or to withdraw your school district's participation at any time. Deciding not to participate or choosing to leave the study will not result in any penalty or loss of benefits to which the school district is entitled.

If you decide to leave the study, the information you have already provided will be destroyed. The researchers will take extreme caution to maintain the confidentiality of each person involved in this study. While every effort will be made to keep confidential all of the information you complete and share, it cannot be absolutely guaranteed. Individuals from the University of Missouri-Kansas City Institutional Review Board (a committee that reviews and approves research studies), Research Protections Program, and Federal regulatory agencies may look at records related to this study for quality improvement and regulatory functions. All MAP scores will remain confidential, and names and school districts will not be used in the researchers' writings. This will avoid risking social, physical and psychological harm to you.

There are no known risks to the school district in this study. The benefit is that there is potentially great value to society in continuing Alternative Certification programs at various institutions in putting additional qualified teachers in the classroom.

The University of Missouri-Kansas City appreciates the participation of people who help it carry out its function of developing knowledge through research. If you have any questions about the study that your school district is participating in, you are encouraged to call Jennifer Wall, the investigator, at (phone number provided).

Although it is not the University's policy to compensate or provide medical treatment for persons who participate in studies, if you think you have been injured as a result of participating in this study, please call the IRB Administrator of UMKC's Social Sciences Institutional Review Board at (phone number provided).

Thank you for your time,

Jennifer Wall
Ph.D. Student
University of Missouri – Kansas City
(contact information provided)

Participant's Name (please print) _____

Participant's Signature _____ date _____

Investigator's Name (please print) _____

Investigator's Signature _____ date _____

APPENDIX D

Data Compilation Information Form

I, _____, the superintendent (or superintendent's designee) of _____ School District have signed the Consent for School District's Participation in the Alternative Certification Research Study. In doing so, I have agreed to release students' demographic information and mathematics MAP scores to the researcher, Jennifer Wall. It is preferable that students remain anonymous to the researcher. To maintain students' anonymity, it is necessary to have someone within the school district compile the data for the researcher. However, in school districts without staff available to compile the data, the superintendent (or superintendent's designee) may approve the researcher to compile the data. The researcher will do so within the district, and all identifiable information will be removed before leaving the building by replacing students' names with numbers (1, 2, 3, - not school, state or federal ID numbers). The researcher will maintain students' confidentiality and anonymity by not keeping any identifiable information in the records. If the school district desires the researcher to compile the data, please sign on the line below:

_____ date _____

If the school district wishes to compile the data to maintain students' anonymity from the researcher, please provide the information on who will be compiling the data below:

Name _____

Title _____

Address _____

Phone Number _____

A list of variables and descriptions is attached.

Variable	Description	Method of Collection
Teacher Name	Teachers' names will be used to collect their students' information. Once I receive students' data from school district or from DESE, I will replace the teachers' names with their IDs. The teachers names and IDs will only be known to me. Teachers' names will not be used in analysis or in any writings.	Recruitment process
Teacher ID	The link between the teachers' names and the teachers' IDs will only be available to me. I will use the teachers' IDs in during the data analysis process.	I will assign these after the recruitment process.
Teacher Certification Route	The teacher's certification route will either be traditional or alternative.	Recruitment process
Teacher Gender	The teacher's gender will either be male or female.	Recruitment process
Teacher Ethnicity	The teachers will report their own ethnicity.	Recruitment process
Teacher Age	The teachers will report their own age.	Recruitment process
Teacher's Years Experience	The teachers will report the number of years they have been teaching through the 2007-2008 school year.	Recruitment process
Teacher's Experience Teaching Course	The teachers will report the number of years they have been teaching specific courses for which I will collect MAP data.	Recruitment process
Course Name	This is the mathematics course in which the student was enrolled during the 2007-2008 school year.	Recruitment process - I will specify to the school district the courses for which I need student data.
Student Number (1, 2, 3, etc)	The students' numbers will be created by either DESE or the school district so that students' names remain anonymous to the researcher. These numbers will not be able to be traced back to the students in any way.	School District
Student Grade (8th, 9th, etc.)	This is the grade the student was in during the 2007-2008 school year, the year in which the student took the MAP test.	School District
Academic Year	The Academic Year is the year in which the student earned the mathematics MAP score. Each student should have a score for the 2007-2008 academic year.	School District
Student Gender	The student's gender will either be male or female.	School District
Student Ethnicity	The students' ethnicity will be what is on file in either the school's or DESE's database.	School District
08 MAP scale score	The 2008 MAP scale score is the numeric score earned by the student.	School District

Variable	Description	Method of Collection
08 MAP achievement level	The 2008 MAP achievement level is based on the scale score. There are four achievement levels: Below Basic, Basic, Proficient, Advanced	School District
08 TerraNova National Percentile	The 2008 TerraNova National Percentile is calculated for the nationally normed TerraNova Survey.	School District
Previous MAP scale score	The Previous MAP scale score is the numeric score earned prior to the 2008 test.	School District
Previous MAP achievement level	The Previous MAP achievement level is based on the scale score earned prior to the 2008 test. There are four achievement levels: Below Basic, Basic, Proficient, Advanced	School District
Previous TerraNova National Percentile	The Previous TerraNova National Percentile is calculated for the nationally normed TerraNova Survey and was earned prior to the 2008 test.	School District

REFERENCES

- AACTE. (1985). Alternative certification: A position statement of the AACTE. *Journal of Teacher Education*, 36(3), 24.
- Beach, D. M., & Littleton, M. (1991). Staffing secondary schools: A successful alternative. *Clearing House*, 65(1), 29-34.
- Boe, E. E., Shin, S., & Cook, L. H. (2007). Does teacher preparation matter for beginning teachers in either special or general education? *The Journal of Special Education*, 41(3), 158-170.
- Boser, J. A., & Wiley, P. D. (1988). An alternative teacher preparation program: Is the promise fulfilled? *Peabody Journal of Education*, 65(2), 130-142.
- Boyd, D., Goldhaber, D. D., Lankford, H., & Wyckoff, J. (2007). The effect of certification and preparation on teacher quality. *The Future of Children*, 17(1), 45-68.
- Boyd, D., Grossman, P., Lankford, H., Loeb, S., & Wyckoff, J. (2006). How changes in entry requirements alter the teacher workforce and affect student achievement. *American Education Finance Association*, 1(2), 176-216.
- Brewer, T. M. (2003). The "Grand Paradox" in teacher preparation and certification policy. *Arts Education Policy Review*, 104(6), 3-10.
- Cohen-Vogel, L., & Smith, T. M. (2007). Qualifications and assignments of alternatively certified teachers: Testing core assumptions. *American Educational Research Journal*, 44(3), 732-753.

- Conklin, H. G., & Zeichner, K. M. (2005). Teacher education programs. In M. Cochran-Smith & K. M. Zeichner (Eds.), *Studying Teacher Education: The Report of the AERA Panel on Research and Teacher Education* (pp. 645-735). Mahwah: Lawrence Erlbaum Associates, Inc.
- Constantine, J., Player, D., Silva, T., Hallgren, K., Grider, M., & Deke, J. (2009). *An evaluation of teachers trained through different routes to certification, final report (NCEE 2009-4043)*. Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
- CTB/McGraw-Hill. (2008a). Missouri Assessment Program Technical Report 2008. Retrieved May 8, 2009, from <http://dese.mo.gov/divimprov/assess/index.html>
- CTB/McGraw-Hill. (2008b). *Missouri Assessment Program: Guide to interpreting results*. Monterey: Missouri Department of Elementary and Secondary Education.
- Darling-Hammond, L., Chung, R., & Frelow, F. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach? *Journal of Teacher Education*, 53(4), 286-302.
- Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness. *Education Policy Analysis Archives*, 13(42).
- Decker, P. T., Mayer, D. P., & Glazerman, S. (2004). *The effects of Teach for American on students: Findings from a national evaluation*: Mathematica Policy Research.
- Education, U. S. D. o. (2004). *Innovations in education: Alternative routes to teacher certification*. Washington, D.C.: U.S. Department of Education.

- Ehrenberg, R. G., & Brewer, D. J. (1994). Do school and teacher characteristics matter? Evidence from *High School and Beyond*. *Economics of Education Review*, 13(1), 1-17.
- Ehrenberg, R. G., Goldhaber, D. D., & Brewer, D. J. (1995). Do teachers' race, gender, and ethnicity matter? Evidence from the national educational longitudinal study of 1988. *Industrial and Labor Relations Review*, 48(3), 547-561.
- Erekson, T. L., & Barr, L. (1985). Alternative credentialing: Lessons from vocational education. *Journal of Teacher Education*, 36(3), 16-19.
- Evertson, C. M., Hawley, W. D., & Zlotnik, M. (1985). Making a difference in educational quality through teacher education. *Journal of Teacher Education*, 36(3), 2-12.
- Feistritzer, E. (2007). *Preparing teachers for the classroom: The role of The Higher Education Act and No Child Left Behind*.
- Field, A. (2005). *Discovering statistics using SPSS* (Second ed.). London: SAGE Publications Ltd.
- Finn, C. E. J., & Madigan, K. (2001). Removing the barriers for teacher certification. *Educational Leadership*, 58(8), 29-31, 36.
- Foster, A. M., Mantle-Bromley, C., Wayman, J. C., & Wilson, C. A. (2003). A comparison of the professional concerns of traditionally prepared and alternatively licensed new teachers. *The High School Journal*, 86(3), 35-40.
- Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (Eighth ed.). Boston: Pearson Education, Inc.

- Goldhaber, D. D., & Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation & Policy Analysis*, 22(2), 129-145.
- Haberman, M. (2001). The creation of an urban normal school: What constitutes quality in alternative certification? *Educational Studies*, 32(3), 278-288.
- Hewitt, T. W. (2006). *Understanding and shaping curriculum: What we teach and why*. Thousand Oaks: Sage Publications, Inc.
- Houston, W. R., Marshall, F., & McDavid, T. (1993). Problems of traditionally prepared and alternatively certified first-year teachers. *Education and Urban Society*, 26(1), 78-89.
- Humphrey, D. C., & Wechsler, M. E. (2007). Insights into alternative certification: Initial findings from a national study. *Teachers College Record*, 109(3), 483-530.
- Humphrey, D. C., Wechsler, M. E., & Hough, H. J. (2008). Characteristics of Effective Alternative Teacher Certification Programs. *Teachers College Record*, 110(4).
- Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2007). Photo Finish. *Education Next*, 7(1), 60-67.
- Knight, S. B., Owens, E. W., & Waxman, H. C. (1990). Comparing the classroom learning environments of traditionally and alternatively certified teachers. *Action in Teacher Education*, 12(4), 29-34.
- Laczko-Kerr, I., & Berliner, D. C. (2002). The effectiveness of "Teach for America" and other under-certified teachers on student academic achievement: A case of harmful public policy. *Education Policy Analysis Archives*, 10(37).

- Madaus, G., Clark, M., & O'Leary, M. (2003). A century of standardized mathematics testing. In G. M. A. Stanic & J. Kilpatrick (Eds.), *A History of School Mathematics* (Vol. 2). Reston: National Council of Teachers of Mathematics.
- Marzano, R. J. (2006). *Classroom assessment & grading that work*. Alexandria: Association for Supervision and Curriculum Development.
- Miller, J. W., McKenna, M. C., & McKenna, B. A. (1998). A comparison of alternatively and traditionally prepared teachers. *Journal of Teacher Education*, 49(3), 165-177.
- Missouri Department of Elementary and Secondary Education. (2004) Mathematics grade level expectations. Retrieved June 22, 2008, from <http://www.dese.mo.gov/divimprove/curriculum/GLE/Math%20GLE%20FINAL%20-%20ALL%20SECTIONS.DOC>.
- Missouri Department of Elementary and Secondary Education. (2006). Missouri Assessment Program Technical Report. Retrieved August 11, 2008, from http://www.dese.mo.gov/divimprove/assess/tech/2006_mo_tech-report.pdf
- Missouri Department of Elementary and Secondary Education. (2007). Missouri Assessment Program Technical Report. Retrieved August 11, 2008, from <http://www.dese.mo.gov/divimprove/assess/tech/Final%20MAP%20Tech%20Report.pdf>
- Missouri Department of Elementary and Secondary Education. (2009). Teacher Quality & Urban Ed. Retrieved July 24, 2009, from <http://dese.mo.gov/divteachqual/teachcert/alternative.html>

- Mitchell, K. J., Robinson, D. Z., Plake, B. S., & Knowles, K. T. (2001). *Testing teacher candidates: The role of licensure tests in improving teacher quality*. National Research Council, Washington, D.C.: National Academy Press.
- Ng, J., & Thomas, K. (2007). Cultivating the cream of the crop: A case study of urban teachers from an alternative teacher education program. *Action in Teacher Education, 29*(1), 3-19.
- No Child Left Behind Act of 2001, 20 U.S.C. 70 § 6301 *et seq.* (2002)
- Owings, W. A., Kaplan, L. S., Nunnery, J., Marzano, R., Myran, S., & Blackburn, D. (2006). Teacher quality and Troops to Teachers: A national study with implications for principals. *NASSP Bulletin, 90*(2), 102-131.
- Rao, P. V. (1998). *Statistical research methods in life sciences*. Pacific Grove: Brooks/Cole Publishing Company.
- Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417-458.
- Rockoff, J. E. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *American Economic Review, 94*(2), 247-252.
- Shen, J. (1999). Alternative certification: Math and science teachers. *Educational Horizons, 78*(1), 44-48.
- Shepherd, T. L. (1999). A retrospect and introspect of an alternative method of teacher certification. *Educational Horizons, 78*(1), 39-43.
- Sindelar, P. T., Daunic, A., & Rennells, M. S. (2004). Comparisons of Traditionally and Alternatively Trained Teachers. *Exceptionality, 12*(4), 209-223.

- Spellings, M. (2005, November 18, 2005). Key Policy Letters Signed by the Education Secretary or Deputy Secretary. Retrieved November 11, 2007, from <http://www.ed.gov/policy/elsec/guid/secletter/051021.html>
- Suell, J. L., & Piotrowski, C. (2006). Efficacy of alternative teacher certification programs: A study of the Florida model. *Education, 127*(2), 310-315.
- United States Department of Education. (2004) *Innovations in education: Alternative routes to teacher certification*. Washington, D.C.: U.S. Department of Education.
- Walsh, K. (2001). *Teacher certification reconsidered: Stumbling for quality*. Baltimore: Abell Foundation.
- Walsh, K., & Jacobs, S. (2007). *Alternative Certification Isn't Alternative*. Washington, D.C.: Thomas B. Fordham Institute.
- Webb, N. L. (2005). Web alignment tool (WAT) training manual. Retrieved June 11, 2008, from <http://www.wcer.wisc.edu/WAT/Training%20Manual%202.1%20Draft%20091205.doc>
- Wenglinsky, H. (2002). How schools matter: The link between teacher classroom practices and student achievement performance. *Education Policy Analysis Archives, 10*(12).

VITA

Jennifer Joanne Wall was born in St. Louis, Missouri on March 22, 1981. She attended Columbia Community School District #4 in Columbia, Illinois and Kirkwood Senior High in Kirkwood, Missouri. She graduated cum laude and earned bachelor's degrees in Spanish and Mathematics Education from Northwest Missouri State University in Maryville, Missouri. Upon completion of undergraduate work, she taught high school Spanish while pursuing her M.S.Ed. in Mathematics Education. She is currently employed at Northwest Missouri State University and works with undergraduate students including pre-service teachers.

Ms. Wall is a member of the National Council of Teachers of Mathematics, Missouri Council of Teachers of Mathematics and the Association of Mathematics Teacher Educators. She is also vice-present of Missouri Mathematics Association for Advancement of Teacher Training.