THE IMPACT OF NATIONAL BOARD TEACHER CERTIFICATION ON SCHOOL CAPACITY

by

Sandra Kaye Michels

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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Abstract

The purpose of this *ex post facto* causal-comparative study is to examine whether a greater number of National Board certified teachers on a school staff has an effect on school-wide standardized assessment outcomes. National Board teacher certification has been examined by researchers as a potential school improvement initiative to address persistent gaps in achievement as measured by state-mandated standardized assessments. The impact of National Board teacher certification on student outcomes has been examined at the individual classroom level and at the statewide level through analysis of scores on the National Assessment of Educational Progress (NAEP). This study explored the impact of National Board teacher certification on school-wide assessment outcomes, and, specifically, whether greater numbers of National Board certified teachers on a school staff have an effect on school-level assessment data. Data were gathered from the Wisconsin Information System for Education (WISEdash) database and from the National Board Certified Teacher Directory. Analysis of variance (ANOVA) was performed using mean score differences between the independent variable of percentage of National Board certified teachers on a school staff and the dependent variable of school-level growth scores in English language arts and mathematics. The study sample size included 161 schools. For each school type group (elementary, middle, high), a statistically significant difference was found between the school-level growth scores in English language arts and mathematics of schools with a low percentage (0-3%) and schools with a medium percentage (3-7%) and high percentage (greater than 7%) of NBCTs on staff.

Keywords: National Board teacher certification, school improvement, student achievement, instructional quality, teacher capacity, school capacity

Dedication

This dissertation is dedicated to my children, Eleanora, William, Matthias, and Adelaide, who inspire me with their patience, their curiosity, and their ability to think beyond the task. This research is also dedicated to my bonus daughter, Dajahnae, whose courage and resilience amaze and encourage me.

I am grateful to have each of you in my life. I love you.

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List of Abbreviations

Every Student Succeeds Act (ESEA)

Institutional Review Board (IRB).

National Assessment of Educational Progress (NAEP)

National Board (NB)

National Board Certification (NBC)

National Board Certified Teacher (NBCT)

National Board for Professional Teaching Standards (NBPTS)

No Child Left Behind School Improvement Act (NCLB)

Trends in International Mathematics and Science Study (TIMSS)

Wisconsin Student Assessment System (WSAS)

CHAPTER ONE: INTRODUCTION

Overview

The purpose of this quantitative, causal-comparative research is to establish whether there is a difference in school-level English language arts and mathematics growth scores between schools with low, medium, and high percentages of National Board certified teachers on staff. Chapter one provides a background of National Board teacher certification and school improvement efforts influenced by the passage of the No Child Left Behind School Improvement Act (NCLB) in 2001. The background includes an explanation of the theoretical framework for this study. The problem statement situates the issue within the recent literature on the topic. The purpose of the study is discussed, followed by a statement of the significance of this research to educational leaders and policy makers. The research questions are presented and key terms related to the study are identified and defined.

Background

Throughout the 1900s, many school reform initiatives were implemented to improve the condition of public education in the United States. These reform initiatives often responded to changing needs in American society (Corsi, 2020; Ravitch, 2013). To address concerns about the lack of trained workers, policy makers advanced legislation that required schools to provide industrial and vocational education programs. When unemployment was at a critical high during the 1930s, school reform focused on student engagement, keeping students in schools and off the unemployment rolls. Successive reform efforts highlighted the need for work and life skills in the 1940s, a return to academic subject disciplines and higher standards in the 1950s, more freedom from routine and fewer academic requirements along with school desegregation in

the1960s, and minimum competency testing in the 1970s (Ravitch, 2013). The decades of the 1980s and 1990s saw school reform efforts proliferate (Nowlin, 2012). Reform initiatives focused on the perceived threat to American economic and military security and expanded the role of federal funding in education.

In 1983, the National Commission on Educational Excellence published *A Nation at Risk,* a report detailing the urgent need to reform the nation's schools in order to protect the future of the nation's students. The commission indicated that the education provided in the nation's schools was not preparing students to succeed in an increasingly competitive global economy. Inadequate student achievement scores and graduation rates were indications of a crisis in education that threatened the economic viability of the nation. The commission recommended school improvement reforms that included rigorous academic content, instruction tailored to the needs of specific groups of learners, and well-trained, competitively-paid teachers. (National Commission on Excellence in Education, 1983).

In response to the concerns identified by the Commission on Educational Excellence and presented in *A Nation at Risk*, the Carnegie Forum on Education and the Economy published *A Nation Prepared: Teachers for the 21st Century*. This report included an ambitious plan to place a highly qualified teacher in every classroom (Carnegie Task Force on Teaching as a Profession, 1986). The National Board for Professional Teaching Standards (NBPTS) was founded in 1987 as part of this plan. The mission of the NBPTS is to provide rigorous standards for what teachers should know and be able to do, provide a process of advanced certification for teachers whose professional practice meets those standards, and advocate for education reforms utilizing the expertise of accomplished teachers (NBPTS, n.d.a). There are currently 128,551 National Board

certified teachers in the United States, representing about 3% of the nation's teachers (NBPTS, n.d.b). There are 1,508 National Board certified teachers practicing in Wisconsin.

In 2001, the 1965 Elementary and Secondary Education Act was reauthorized as the No Child Left Behind Act (NCLB). With the passage of NCLB, the federal government expanded its role in education policy. NCLB required school districts to administer standardized assessments in reading and math to students in grades 3 through 8 and to report the results of those assessments to the public. Schools were required to report assessment results for specific groups of students representing gender and race categories as well as categories of limited English proficiency, economically disadvantaged, and student with disabilities. The legislation required that all teachers be highly qualified and that increasing numbers of students achieve at least proficient scores on mandated annual assessments (Jacob, 2017).

These events impacting education policy affected educational research, bringing a new phase of educational effectiveness research informed by combining educational effectiveness and school improvement research. Improved theoretical and methodological approaches, along with the new focus on evidence-based education, increased the sophistication of educational research efforts (Creemers & Reezigt, 2005; Markley, 2004; Reynolds et al., 2014; Scheerens, 2014; Teddlie & Reynolds, 2000). School leaders and policy makers began to examine the evidence base in the research along with the data from standardized assessments to inform leadership decisions and school improvement plans.

The value placed on educational reforms through concepts such as excellence and equity of opportunity are merely a way of communicating that education is a subsystem of society (Corsi, 2020; Ravitch, 2013). The pursuit of reform in education is a response to trends in society. At a time when the national economy faced strong global competition, the skills required

to compete in that social context became the focus of educational reform. Improving student academic growth, as measured by achieved proficiency levels on tests of reading and math, was identified as a way to prepare future adults to compete in the global marketplace. School reform movements have focused on school governance, teacher preparation, instruction, curriculum standards, professional development, and student learning to improve student test scores (Ravitch, 2013; Nowlin, 2012; Zhao, 2009). The teacher represents a common theme running through each of the school reform movements. Teachers were seen as central to each initiative; to ensure quality learning, changes were needed at the school level with the classroom teacher. Reforms have given attention to instructional practices, the role of the teacher in the building, instructional monitoring, and teacher quality and certification. Researchers and policy makers have agreed that teachers play an important role in educational change (Nurul Azkiyah, 2017; Benoliel & Berkovich, 2016; Looney, 2011; Mincu, 2015; Reynolds, et al., 2014). The National Board for Professional Teaching Standards (NBPTS) created an advanced certification that identified quality teachers who were able to impact both student learning and the professional community through a national teacher certification process.

With the passage of NCLB, the concern for accountability and the use of high stakes assessment brought attention to teacher quality in an effort to improve student scores on standardized assessments. Researchers identified the teacher as the critical school-related factor impacting student academic growth (Cheng & Zamarro, 2018; Churchward & Willis, 2019; Darling-Hammond, 2015; Hanushek, 2011; Hattie, 2009; König & Pflanzl, 2016; Mincu, 2015). School improvement efforts have focused on teacher preparation programs and professional development efforts that produce gains in student achievement (Adolfsson, & Håkansson, 2019;

Houston & Hood, 2017). These researchers asserted that the characteristics that make teachers effective can be identified and evaluated in order to improve student performance.

This analysis is framed by Bandura's theory of social cognitive learning (1986). Bandura's theory of social learning explains human behavior in terms of interactions among personal, behavioral, and environmental factors (1971, 1977). The social learning perspective suggests that the process of learning is driven by the observation of models during social experiences. Learners observe the actions of others who are modeling task completion and then reproduce those actions to perform the tasks themselves.

Social cognitive learning theory extended social learning theory by introducing cognitive processes into the learning process (Bandura, 1986). Cognitive processes interact with social experiences to impact learning outcomes. Cognition affects how individuals interpret the environment and interact with thoughts, feelings, and beliefs to produce new learning. According to social cognitive learning theory, human learning occurs when individuals observe the behaviors of others, interpret observed behaviors, make decisions about choosing behaviors, and act out those behaviors. Individuals use self-regulatory processes to manage their thoughts, feelings, and actions within their environment to accomplish tasks.

Learning occurs in a social context through reciprocal interaction of the person, environment, and behavior (Bandura, 1989). Social cognitive theory explains the process people use to regulate their behavior via control and reinforcement to achieve goal-directed behavior through the constructs of reciprocal determinism, behavioral capability, observational learning, expectations, and self-efficacy. The construct of self-efficacy contributed to understanding about people's thought processes regarding their ability to control their decisions and outcomes. An individual's self-efficacy is informed by mastery experiences, vicarious experiences, verbal

persuasion, and physiological arousal (Bandura, 1977). These experiences, processed through cognitive functioning, impact individual self-regulated behavior. Perceived self-efficacy affects how an individual approaches tasks, persists toward task completion, and interacts with others to complete tasks. Teacher self-efficacy is grounded in Bandura's theory of self-efficacy and refers to teachers' perceived beliefs and judgments about their capability to complete a given task or activity necessary to achieve expected levels of performance (Bandura, 1986).

Bandura (1993) demonstrated that collective teacher efficacy affected student learning more than socioeconomic factors and that collective teacher efficacy was predictive of school performance. He indicated that collective efficacy, the belief of individuals in the group's ability to accomplish a given task, influences individuals' thoughts, feelings, and behaviors, and by that process, affects school outcomes. The impact of collective teacher efficacy manifests in the interaction between beliefs, teaching behavior, and the school environment as student achievement. Within these reciprocal interactions, then, the improved student achievement may fuel increased collective efficacy and enhanced instructional practices.

Social cognitive learning theory illustrates that teaching practices are impacted by the interactions between teachers in a school environment. Accomplished teachers may elevate the level of professional discourse within those interactions. The question is, does a greater number of accomplished teachers interacting within a school influence professional practice and, as a result, student learning?

Problem Statement

Educational efforts to close persistent gaps in achievement as measured by state-mandated standardized achievement tests have not yet been successful. The search for school

improvement efforts to meet this need is ongoing. National Board teacher certification has been examined by researchers as part of this search. The impact of National Board teacher certification on student outcomes at the individual classroom level has been examined by several researchers (Belson & Husted, 2015; Cowan & Goldhaber, 2016; Horoi & Bhai, 2018; National Strategic Planning & Analysis Research Center, 2017). Researchers have found that students who have National Board certified teachers experience greater academic outcomes. Belson and Husted (2015) analyzed the impact of National Board teacher certification on student achievement using national testing data. These researchers found that states with greater numbers of National Board certified teachers achieved higher scores on the National Assessment of Educational Progress (NAEP). The problem is that student achievement as measured by state-mandated achievement tests has not reached a satisfactory level set by the established benchmarks. This achievement gap has persisted despite the efforts of researchers to identify appropriate solutions. Additional research is needed to identify whether National Board teacher certification is one such solution, and, specifically, whether greater numbers of National Board certified teachers on a school staff have an effect on school-level assessment data.

Purpose Statement

The purpose of this *ex post facto* causal-comparative study is to examine whether a greater number of National Board certified teachers on a school staff has an effect on school-wide standardized achievement outcomes. This study will examine the mean score differences between the independent variable of percentage of National Board certified teachers on a school staff and the dependent variable of school-level growth scores in English language arts and mathematics. For the current study, National Board certified teachers will be defined as teachers

who have completed the National Board certification process successfully and have been awarded National Board teacher certification. The percentage of National Board certified teachers on a school staff will be calculated by dividing the number of National Board certified teachers on staff by the total number of teachers on staff. English language arts growth scores will be defined as the value-added scores calculated to indicate the difference between predicted and actual growth over time of students with similar characteristics in English language arts skills assessed by the standardized assessments in the Wisconsin Student Assessment System. Mathematics growth scores will be defined as the value-added scores calculated to indicate the difference between predicted and actual growth over time of students with similar characteristics in mathematics skills assessed by the standardized assessments in the Wisconsin Student Assessment System. School growth scores in English language arts and mathematics are reported on Wisconsin accountability report cards for individual schools. The value-added growth scores reported on the school accountability report cards are calculated from standardized assessment scores reported to the Wisconsin Department of Public Instruction by individual schools. The calculated growth score is represented as a single data point for English language arts and a single data point for mathematics on the school accountability report card. The dependent variable for this study will be the school-level growth score for English language arts and the school-level growth score for mathematics reported on the school accountability report cards.

Data were gathered from the Wisconsin Information System in Education dashboard (WISEdash) data archive and from the National Board Certified Teacher (NBCT) directory. The student growth scores in English language arts and mathematics were collected from the state accountability report cards for participant schools for the 2018-2019 school year. English language arts and mathematics growth scores from 161 schools in the state for students in third

through fifth grades, sixth through eighth grades, and ninth through eleventh grades will be collected for the 2018-2019 school year. Teachers who have earned National Board teacher certification will be identified from the NBCT directory. The number of teaching staff in participant schools during the 2018-2019 school year will be collected from the WISEdash All Staff report.

Causal-comparative research designs can be used to examine relationships between variables to explain a phenomenon (Gall, et al., 2007). Causal-comparative is an effective design to use in situations where the variables cannot be manipulated (Mertler, 2019). Archived data in state educational databases have been used to identify student achievement levels in education research and to examine factors that affect student learning (Blackwell & Stockall, 2019; Halloway et al., 2017; Mohr-Schroeder et al., 2017; Zucker, 2013).

Significance of the Study

Teachers have a significant effect on student learning outcomes (Cheng & Zamarro, 2018; Churchward & Willis, 2019; Darling-Hammond, 2015; Hanushek, 2011; Hattie, 2009; König & Pflanzl, 2016; Mincu, 2015). Teacher quality has been examined and defined as teacher credentials, teaching behaviors, and impact on student learning (Danielson, 2007; Goe, 2007; Hattie, 2012; Palacios, 2017; Skourdoumbis, 2017a). The National Board for Professional Teaching Standards created the National Board teacher certification process with the goal of identifying and acknowledging accomplished teachers. The certification process requires teachers to show that their teaching exemplifies what accomplished teachers should know and be able to do by completing an assessment of content and pedagogical knowledge and by demonstrating practical understanding of effective teaching through analysis of their video

recorded instruction and samples of student work (NBPTS, 2020a). This study explored National Board teacher certification as a school improvement initiative. The examination of the impact of greater numbers of National Board certified teachers on school-level assessment data may add to the discussion of school improvement approaches.

Researchers have demonstrated that National Board teacher certification may have a positive effect on student outcomes at the individual student level and at the state level (Belson & Husted, 2015; Cowan & Goldhaber, 2016; Horoi & Bhai, 2018; National Strategic Planning & Analysis Research Center, 2017). This study contributed to the research base by examining the effect of National Board teacher certification on school-level achievement outcomes and, specifically, whether having a greater number of National Board certified teachers on a school staff has an impact on school-level assessment dataa.

School improvement research focused on teacher quality has examined mechanisms by which teacher quality can be identified and supported to improve student learning (Courtney, 2019; Looney, 2011; Mincu, 2015; Reynolds, et al., 2014). National Board certified teachers are accomplished teachers who provide high quality academic instruction to their students (Cowan & Goldhaber, 2016). Students who are provided high quality academic instruction are more likely to experience optimal learning and academic achievement (Chetty et al., 2014a; Darling-Hammond, 2014) as well as improved outcomes in adulthood (Chetty et al., 2014b). As students who experience optimal learning through high quality academic instruction matriculate from the school setting, all members of the wider community benefit from these students' potential to be successful members of society. This study may inform the professional discourse around quality teachers and school improvement initiatives.

Research Questions

The research questions for this study are:

RQ1: Are there differences in the English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

RQ2: Are there differences in the mathematics growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

RQ3: Are there differences in the English language arts growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

RQ4: Are there differences in the mathematics growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

RQ5: Are there differences in the English language arts growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

RQ6: Are there differences in the mathematics growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

RQ7: Are there differences in the English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

RQ8: Are there differences in the mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

Definitions

1. *Agency* – Agency is how people exercise control over their own lives (Goddard et al., 2004); agency expresses one's belief about one's ability to exercise control over events affecting one's life (Bandura, 1989).

2. *Capacity* – Capacity is the potential of a school to improve over time (Beaver & Weinbaum, 2012); capacity is the ability to meet goals and to develop (Adolfsson & Hakansson, 2019).
3. *Collective efficacy* – Collective efficacy is the perception of the group about its collective ability to accomplish tasks (Goddard et al., 2004); collective efficacy is the belief of individuals in the group's ability to accomplish a given task (Bandura, 1993).
4. *High stakes assessment* – High stakes assessment results have consequences for students, teachers, or schools (Holloway et al., 2017); high stakes assessment results may impact teachers, students, or parents (Blackwell & Stockall, 2019).
5. *Human capital* – Human capital is the intrinsic capability of a teacher to teach effectively (Cavalluzzo, et al., 2014); human capital is the amount schools benefit from the unique personal and professional characteristics of individual teachers (Beaver & Weinbaum, 2012).
6. *Instructional quality* – The dimensions of instructional quality include cognitive activations, supportive climate, classroom management, and clarity of instruction (Nilsen, et al., 2016).
7. *National Board for Professional Teaching Standards (NBPTS)* – NBPTS is a non-profit educational policy organization established in 1987. NBPTS was created as an independent, nonpartisan, and nongovernmental organization with the purpose of creating high and rigorous national professional standards designed to illustrate what accomplished teachers should know and be able to do (NBPTS, 2020a).

8. *National Board Teacher Certification* – National Board Teacher certification is an advanced professional certification earned through a voluntary assessment process that signifies a high level of teaching practice (Cowan & Goldhaber, 2016).
9. *Perceived self-efficacy* – Perceived self-efficacy is a person's belief in their ability to accomplish a task (Bandura, 1977).
10. *Social Learning Theory*- Social learning theory posits that people change their behaviors because of the models and social cues around them (Bandura, 1977).
11. *Standardized achievement test* - A test that is administered under standardized conditions; designed to be reliable, valid, and fair. Standardized achievement tests are used to measure the achievement of large groups of students efficiently and affordably (Zucker, 2013).
12. *Teacher effectiveness* – Teaching effectiveness is demonstrated by teaching behavior that results in student learning and proficient student test scores (Goe, 2008); teacher effectiveness is comprised of high quality teaching that results in student learning as represented by gains in achievement (Bardach and Klassen, 2020); "an effective teacher is one who demonstrates knowledge of the curriculum, provides instruction in a variety of approaches to varied students, and measurably increases student achievement" (Markley, 2004, p. 9).
13. *Teacher efficacy* – Teacher efficacy describes a teacher's belief that students can learn and the instructional behavior of the teacher can facilitate student learning (Woods & Rhoades, 2013).
14. *Teacher quality* – Teacher quality is a combination of inputs (qualifications and characteristics), processes (practices), and outcomes (effectiveness) (Goe, 2007).

15. *Value added* – Value added is a process of using complex statistical methods to discern the impact of specific teachers, schools, or districts on student learning (Looney, 2011); value added is a method of identifying a teacher's influence on a student's academic growth (Courtney, 2019).

CHAPTER TWO: LITERATURE REVIEW

Overview

Chapter two presents a systematic review of the literature conducted to explore the question of whether an increased number of National Board certified teachers on a school staff has an effect on school-level achievement outcomes. In the first section, social cognitive learning theory will be discussed in relation to teaching practice and student achievement, followed by a synthesis of recent literature regarding National Board teacher certification and the impact of National Board certified teachers on student achievement and on teacher and school capacity. The National Board process has been correlated with improved teaching practice and improved student learning. In addition, the National Board teacher certification process has been identified as a possible school improvement initiative through identification of quality teaching, professional development, and recruitment and retention efforts. The current study adds to this discussion by examining whether a greater number of National Board certified teachers on a school staff have an effect on school-wide student achievement.

Theoretical Framework

The National Board for Professional Teaching Standards (NBPTS) was founded in 1987. The mission of NBPTS is to "advance the quality of teaching and learning through a voluntary advanced certification" (NBPTS, n.d.a.). The National Board certification process provides a framework for discussing teacher practice. The framework rests on five core propositions that identify what exceptional teachers should know and do (NBPTS, 2016):

- Teachers are committed to students and their learning
- Teachers know the subjects they teach and how to teach those subjects to students

- Teachers are responsible for managing and monitoring student learning
- Teachers think systematically about their practice and learn from experience
- Teachers are members of learning communities

The standards used to assess teacher performance for National Board teacher certification are unique to each of the 25 certificate areas, but all standards extend from the five core propositions. The National Board certificate-area standards describe teacher practices or behaviors of exemplary teachers. The standards illustrate how the five core propositions are enacted in the daily work of teachers within their content areas. The core propositions reflect teacher dispositions that illustrate characteristics of accomplished teachers and allow for professional discourse among teachers across the licensure areas. Teachers of all subjects and ages interact professionally through engagement with the five core propositions. The framework of the five core propositions may be used to structure an examination of how accomplished teachers interact within their school environment, and whether the professional collaboration within those interactions have an impact on teacher and school capacity.

Core proposition one, teachers are committed to students and their learning, illustrates the premise that teacher behaviors are the enactment of a commitment that can be quantified and realized in teacher practice. Core proposition two, teachers know the subjects they teach and how to teach those subjects to students, indicates a commitment to deep knowledge of the subject and an ability to engage students in learning those subjects and their connection with each other. Core proposition three, teachers are responsible for managing and monitoring student learning, demonstrates that teachers have specialized knowledge in the organizational and procedural aspects of running a classroom and ensuring students are able to progress in skill development. Core proposition four, teachers think systematically about their practice and learn from

experience, illustrates the importance of ongoing learning and improvement in practice that results from thinking reflectively about the work of teaching. Finally, core proposition five, teachers are members of learning communities, demonstrates the potential for expanding the impact of individual teachers through collective growth and collective responsibility within a community of practitioners. The individual certificate area standards to bring to life the five core propositions in the professional practice of educators within their interactions in the school environment.

Social Cognitive Theory

Bandura's theory of social learning explains human learning in terms of interaction between personal, behavioral, and environmental factors (1971, 1977). The social learning perspective suggests that the process of learning is driven by the observation of models and the reproduction of the actions modeled. Individuals reproduce observed behaviors and learn from feedback received from the environment, which is used to inform future behaviors.

According to Bandura (1971, 1977), the fundamental concept of social learning is that learning is an ongoing reciprocal interaction between an individual's behavior and environmental conditions impacted by vicarious symbolic and self-regulatory processes. Bandura developed the model of social learning theory by taking the concepts of classical and operant conditioning presented in behaviorist learning theories and combining them with concepts associated with observational learning and mediating processes. He posited that learning phenomena resulting from direct experiences can also happen vicariously through observation of other people's behavior and the resulting consequences. An individual encodes observed behavior and may imitate observed behaviors later (Bandura, 1971, 1977, 1989). When an individual imitates a behavior, they receive either negative or positive reinforcements from others; this feedback then

affects future behavior imitations. Mediational processes are concerned with the cognitive functions that occur during observational learning. Bandura (1989) defined four mediational processes:

- Attentional processes determine notable behaviors when an individual's attention has been aroused.
- Retention processes encode notable behaviors into an individual's memory.
- Behavioral production processes transform behaviors stored in an individual's memory into intentional actions.
- Motivational processes evaluate positive and negative reinforcements experienced from enacted behaviors to determine future use.

Social cognitive learning theory (Bandura, 1989) expanded on social learning theory (Bandura, 1971, 1977) to explain the process in which people regulate their behavior using control and reinforcement to achieve goal-directed behavior. The theory considers the way in which people acquire and maintain behavior within a social environment. People's past experiences shape behavioral choices and include reinforcements, expectations, and expectancies. The constructs of social cognitive learning theory include:

- Reciprocal determinism – dynamic and reciprocal interaction of an individual with a set of learning experiences, an external social context, and responses to stimuli to achieve goals
- Behavioral capability – a person's actual ability to perform a behavior through essential knowledge and skills
- Observational learning – observing a successful demonstration of a behavior and then accurately reproducing the observed behavior

- Reinforcements – internal or external responses to a person's behavior that affect whether the person repeats the behavior in the future
- Expectations –anticipated results of behavior, developed from previous experiences, influence the decision to take action
- Self-efficacy – confidence in one's ability to perform a behavior successfully, influenced by capabilities and by internal and environmental factors

People observe the actions of others during social interactions within their environment. They make decisions about how to incorporate these observations into their own behaviors. As they interpret the information they receive through social interactions, they regulate their actions to meet their goals. These interactions have reciprocal effects; that is, people affect each other and learn from each other during interactions within their environments. Learning occurs within these reciprocal social interactions.

The construct of self-efficacy (Bandura, 1977) contributed to understanding about how people think about their ability to control their decisions and outcomes. An individual's self-efficacy is informed by

- Mastery experiences – the experience of performing a task to mastery
- Vicarious experiences – learning to perform a task by observing another person perform the task to mastery
- Verbal persuasion – encouraging verbal support for a person's task performance
- Physiological arousal – the level of anxiety or stress affecting the performance of a task

These experiences, processed through cognitive functioning, inform individual self-regulated behavior. Perceived self-efficacy affects how an individual approaches tasks, persists toward task completion, and interacts with others to complete tasks (Bandura, 1977).

Teacher self-efficacy is grounded in Bandura's (1977) theory of self-efficacy. Teachers with higher perceived teaching efficacy are more likely to exert effort to overcome obstacles and to persist in the face of difficult challenges. This high level of resiliency enhances innovative teaching and student learning (Bandura, 1989).

Tschannen-Moran, Hoy, and Hoy (1998) created a model of teacher efficacy to explain the process by which teachers use mastery experiences, vicarious experiences, verbal persuasion, and physiological arousal to inform decisions about self-efficacy as they analyze teaching tasks and their own level of competence to set goals and act with effort toward those goals. Zee and Koomen (2016), in their review of research about teacher efficacy, identified connections between teacher self-efficacy and well-being, including commitment to teaching, personal satisfaction, and job satisfaction. They also found relationships between teacher self-efficacy and teaching practices as well as teacher self-efficacy and student achievement. Teacher self-efficacy influences a wide range of interactions that affect student learning. National Board teacher certification may provide an opportunity for mastery experiences that improve professional practice and enhance teacher efficacy.

Collective Teacher Efficacy

Bandura (1993) demonstrated that collective teacher efficacy had a greater impact on student learning than socioeconomic factors and that collective teacher efficacy was predictive of school performance. He indicated that collective efficacy, the belief of individuals in the group's ability to accomplish a given task, informs individuals' thoughts, feelings, and behaviors, and by that process, impacts school outcomes. Goddard et al. (2000) created a model of collective teacher efficacy to explain the mechanisms by which collective teacher efficacy impacts student learning in school settings. They conceptualized collective efficacy as an extension of individual

efficacy to the organizational level and developed an instrument to measure collective teacher efficacy. Their findings supported Bandura's (1993) concept of collective efficacy and advanced the idea that social cognitive theory can be applied to organizations.

More recent research has focused on collective teacher efficacy as an agent of school reform initiatives (Donohoo, 2018; Donohoo et al., 2018). Donohoo (2018) conducted a review of research focused on collective teacher efficacy in an effort to identify behaviors of practice that result from collective teacher efficacy. She found that greater collective teacher efficacy led to deeper implementation of school improvement strategies. In addition, in schools where collective teacher efficacy was strong, individual teacher efficacy was strong as well. Donohoo et al. (2018) identified collective efficacy as a powerful influence on student achievement. Further, they indicated it is not merely the collective belief in the ability of the group to effect improved student learning, rather, it is the collective belief informed and motivated by evidence of the group's impact on student outcomes that contributes to strengthened collective efficacy (Donohoo et al., 2018). This view illustrates that teacher and school capacity is influenced by the interactions among individuals within the group and the collective action of the group within the school environment, a demonstration of social cognitive theory (Bandura, 1993). The impact of collective teacher efficacy manifests in the interactions among beliefs, teaching behavior, and the school environment as student achievement. In the reciprocal interaction, then, the improved student achievement fuels increased collective efficacy and enhanced instructional practices.

Just as learning happens in the interactions among person, behavior, and environment, collective capacity grows through interactions between people within the school context as they work toward a common goal. In those interactions is located the manifestation of individual and collective efficacy through the constructs identified by Bandura (1993). As mastery experiences,

vicarious experiences, verbal persuasion, and physiological arousal are experienced among colleagues throughout a school community, collective efficacy expands, impacting school-level achievement outcomes. The five core propositions of the National Board certification process and the certificate area standards can be used to frame collaborative teaching and learning interactions among professionals in a school community. As teachers interact through the core propositions and certificate area standards, their collaboration may create and expand knowledge of the application of accomplished teaching between and among their colleagues, impacting teacher and school capacity.

This study examines the impact of National Board teacher certification on school-level learning outcomes. The complex tasks of teaching and learning are carried out through the interactions among educators within the teaching and learning environment. National Board certification is an advanced certification, the gold standard of teacher certification (NBPTS, n.d.). This study contributes to the issue of school and teacher capacity by examining whether a larger number of National Board certified teachers on a teaching staff has an effect on student achievement.

Related Literature

The era of high stakes assessment brought attention to teacher quality in an effort to identify opportunities for policy initiatives aimed at improving student achievement scores. How much teaching behavior affects the learning experienced by students has been a focus of researchers for some time (Chetty et al., 2014a; Hanushek, 2011; Markley, 2004). Educators and researchers continue to ponder what behaviors make the most effective teaching and what

assessment methods are the most effective way to measure whether students are benefiting from the teaching they experience.

Teacher Quality and Student Learning

Researchers have explored how teacher qualities influence student learning. Teachers are a critical school-related factor impacting student achievement (Cheng & Zamarro, 2018; Churchward & Willis, 2019; Darling-Hammond, 2015; Hanushek, 2011; Hattie, 2009; König & Pflanzl, 2016; Mincu, 2015). Teacher quality is a complex concept. The National Board for Professional Teaching Standards (NBPTS) created an advanced certification process to identify and acknowledge quality teachers. National Board teacher certification has been used by researchers as a signal of teacher quality (Horoi & Bhai, 2018) and teacher effectiveness (Cowan & Goldhaber, 2016) as defined through the five core propositions and the certificate area standards and demonstrated through standardized assessment outcomes (Cavalluzzo, et al., 2014; Curry, et al., 2018; Manzeske et al., 2017) and accomplished teacher practices (Belson & Husted, 2015; Kern et al., 2017; Petty et al., 2019; Swan Dagen et al., 2017m,,,,,,,-=).

Other researchers have offered various definitions of quality teaching in an attempt to illustrate and conceptualize the complex nature of teaching. The definitions of quality teaching offered by these researchers are aligned with the definition offered by the NBPTS. Palacios (2017) identified teacher quality in terms of structural measures (education, experience, and certification) and process measures (specific instructional behaviors and teaching philosophy). Skourdoumbis (2017a) discussed characteristics of teachers in terms of teacher quality (credentials) and teacher effectiveness (teaching performance). Goe (2007), in her synthesis of the research, discussed teaching in terms of inputs (teacher licensure and characteristics), processes (teaching practices), and outcomes (student achievement).

Hattie (2012) analyzed thousands of research studies and performed hundreds of meta-analyses to determine patterns and identify effect sizes of teacher practices. He noted that almost all teacher practices produce some effect and he provided a list of the most effective practices for teachers, ranking them by effect sizes as measured through the meta-analyses. The teacher practices identified by Hattie are processes of teaching and the effect sizes indicate the impact on student learning, or outcomes. Hattie identified practices (processes) with high effect sizes (outcomes) above .60 standard deviations, including teacher clarity, feedback, and student expectations; practices with medium effect sizes between .40 and .60 standard deviations, including cooperative learning, direct instruction, and goals; and practices with low effect sizes below .40 standard deviations, including teacher gender, ability grouping, and whole language programs. Hattie and Zierer (2017) also examined teacher mindframes that expand the impact of teacher practices. Hattie's teacher mindframes are:

- I am an evaluator of my impact on student learning.
- I see assessment as informing my impact and next steps.
- I collaborate with my peers and my students about my conceptions of progress and my impact.
- I am a change agent and believe all students can improve.
- I strive for challenge and not merely 'doing your best.'
- I give and help students understand feedback and I interpret and act on feedback given to me.
- I engage as much in dialogue as monologue.
- I explicitly inform students what successful impact looks like from the outset.

- I build relationships and trust so that learning can occur in a place where it is safe to make mistakes and learn from others.
- I focus on learning and the language of learning.

These teacher mindframes are similar to Goe's (2007) teacher characteristics:

- Effective teachers have high expectations for all students and help students learn, as measured by value-added or other test-based growth measures, or by alternative measures.
- Effective teachers contribute to positive academic, attitudinal, and social outcomes for students such as regular attendance, on-time promotion to the next grade, on-time graduation, self-efficacy, and cooperative behavior.
- Effective teachers use diverse resources to plan and structure engaging learning opportunities; monitor student progress formatively, adapting instruction as needed; and evaluate learning using multiple sources of evidence.
- Effective teachers contribute to the development of classrooms and schools that value diversity and civic-mindedness.
- Effective teachers collaborate with other teachers, administrators, parents, and education professionals to ensure student success, particularly the success of students with special needs and those at high risk for failure.

Konig and Pflanzl (2016) measured the general pedagogical knowledge of teachers in Austrian schools. They measured general pedagogical knowledge rather than content knowledge or pedagogical content knowledge. Participants' general pedagogical knowledge was assessed using a short form paper and pencil test that required teachers to respond to test items by recalling content knowledge from long term memory, responding to a test item by analyzing a

concept, specific term, or phenomenon related to practice, or explaining how they would respond to a typical classroom situation through evaluating the situation and using concrete strategies to problem solve. Test items were utilized to evaluate study participants' ability to prepare, structure, and evaluate lessons and to manage classrooms. The authors compared teacher performance on this test with measures of quality teaching in the areas of generic teaching methods/teacher clarity, effective classroom management, and teacher-student relationships as rated by students in a questionnaire. They found a significant positive correlation between teacher general pedagogical knowledge and teacher quality in the areas of teacher methods/teacher clarity (.48, $p < .001$), effective classroom management (.07, $p < .05$), and teacher-student relationships (.53, $p < .001$). These authors connected the teacher characteristics, or inputs, of general pedagogical knowledge with teacher practices, or processes, in their identification of quality teaching.

Samples and Copeland (2013) took descriptors of good teaching developed by engineering faculty and conducted a survey of 66 non-engineering faculty members from two liberal arts institutions to examine whether teaching can be described in the same way across disciplines. The responses to the five questions (What is good teaching?; How is it accomplished?; Is good teaching necessary to have a successful course?; How is it evaluated?; What are the results of good teaching?) were analyzed for trends and themes. The authors found the responses were aligned in themes and, most importantly, arranged around fundamentals that are simple and attainable. The authors declared that good teaching can be accomplished using some simple guidelines that include plan, prepare, practice, organize, communicate, challenge, motivate, and lead the students to learning. These authors identified quality teaching solely by processes, or teacher practices.

Danielson (2007) identified teacher specific behaviors that comprise quality teaching. She organized these teacher behaviors into four categories or domains of performance that, when taken together, form a comprehensive picture of quality teaching. The four domains of teaching include planning and preparation, the classroom environment, instruction, and professional responsibilities. Within each domain, Danielson further organized specific teacher behaviors that apply to that domain. Danielson offered her framework as a road map through teaching; a road map is necessary because teaching is a complex job, one that is physically, emotionally, and cognitively exhausting. Teachers can use the framework to examine their own work against a standard and set goals for further skill development and improved professional performance. Danielson's framework also identifies quality teaching in terms of teacher practices, or processes.

Fitchett and Heafner (2018) examined the practice of quality teachers, defined as the traditional indicators of teaching quality, which are knowledge of the content area and credentialing in the teaching field. The authors studied student scores in history on the National Association of Education Progress (NAEP) assessment for students in eighth grade along with teacher survey data on frequency of use of identified teaching strategies. They found that teachers who were traditionally educated and licensed to teach social studies typically used quality teaching strategies, such as reading across different source materials, discussion, writing, and performance-based assessments, and that their students achieved higher scores on the standardized test. In contrast, students of alternatively licensed teachers achieved lower test scores on the standardized test. Quality teacher indicators included beginning teacher status, National Board Certification, indication of secondary education major/minor/advanced degree, history major/minor/advanced degree, licensure, alternative certification, and exposure to

professional development in the form of conference participation and reading of history/social studies-related material. The authors found that more quality teacher indicators associated with a teacher correlated positively with that teacher's use of quality teaching methods. The quality teaching methods were identified in two groups: read/talk/write (RTW) and performance-based assessment (PBA). NBCTs reported using .40 standard deviations (SD) more RTW than non-certified teachers [$t(720) = 3.59$, $p < .001$]. Teachers with history concentration backgrounds and secondary education backgrounds reported using .22 SD [$t(720) = 2.91$, $p < .01$] and .20 SD [$t(720) = 2.27$, $p < .05$] more RTW, respectively, than teachers who did not have those characteristics. Professional development was associated with increased RTW as well, with conference-related PD resulting in .40 SD more RTW [$t(720) = 5.36$, $p < .001$], and PD related to reading social studies literature resulting in .32 SD increase in RTW [$t(720) = 3.79$, $p < .001$] over teachers who did not participate in these experiences. Beginning teachers reported greater use of PBA (.17 SD) than more experienced teachers [$t(720) = 2.40$, $p < .05$]. Teachers holding alternative licensure reported .24 SD more PBA than traditionally licensed teachers [$t(720) = 2.25$, $p < .05$], and teachers attending PD at conferences correlated to .17 SD more PBA [$t(720) = 2.38$, $p < .05$] than teachers not attending PD at conferences. The authors reported that teacher quality is often a descriptor for teaching behaviors that enhance student learning. They identified quality in terms of teacher inputs of credentialing, including National Board certification, teacher processes of teacher practices (instruction in read/write/talk and performance-based assessment), as well as teacher outputs of student achievement on a standardized test.

The National Board for Professional Teaching Standards (NBPTS) was founded in 1987. The goal of the NBPTS was to establish standards of accomplished teaching and design a

performance-based assessment leading to National Board Certification, indicating the teacher meets the standards of accomplished teaching (NBPTS, n.d.a.). The NBPTS (2016) provided an explication of the five core propositions that form the vision of accomplished teaching. The core propositions, along with certificate area specific standards, define specific knowledge and skills of accomplished teaching (NBPTS, 2021a). The five core propositions are similar to Goe's (2007) teacher characteristics and to the ten teacher mindframes of Hattie and Zierer (2017):

- Teachers are committed to students and their learning.
- Teachers know the subjects they teach and how to teach those subjects to students.
- Teachers are responsible for managing and monitoring student learning.
- Teachers think systematically about their practice and learn from experience.
- Teachers are members of learning communities.

The certificate area standards, along with the explication of the five core propositions, describe quality teaching. National Board teacher certification, then, defines quality teaching by combining the standard definitions of teacher quality, including inputs (National Board certification; teacher characteristics as outlined in the five core propositions) and processes (teacher practices identified in the certificate-area standards). These teacher characteristics and behaviors are similar to those identified by other researchers as effective teacher characteristics and practices (Danielson, 2007; Fitchett & Heafner, 2018; Goe, 2007; Hattie, 2012; Konig & Pflanzl, 2016; Samples & Copeland, 2013).

Considering teacher quality and effectiveness as the only contributors to student achievement, Skourdoumbis (2017b) suggested, can lead to flawed educational policy by denying the complexity of teaching, learning, and school systems. However, teacher quality is essential to student achievement. Nilsen and Gustafsson (2016), using data from the 2011 Trends

in International Mathematics and Science Study (TIMSS) on the performance of 205,515 students from 10,059 classrooms in 47 countries, found that teacher quality was significantly related to instructional quality and student achievement. Fitchett and Heafner (2018) included student achievement on standardized tests as an indicator of teacher quality. Goe (2007) also included student achievement outcomes in her discussion of teacher effectiveness. Teacher quality has been defined as licensure, education, and experience, as well as philosophy, instructional behaviors, and teaching practices; teacher quality also includes the ability to impact student learning and achievement.

Measuring Student Achievement

Researchers and educators have searched for effective ways to measure student learning. Researchers have examined various methods of measuring what students know and how much students learned throughout a lesson, unit, or grade level academic year. Butler and McMunn (2011) examined multiple ways of assessing student learning in the classroom. They provided strategies teachers can use to gather the most useful data for improving instruction. The authors discussed the use of high-stakes standardized assessments in schools and defined standardized as having uniform implementation across settings and high-stakes as resulting in data that is used to make decisions. They identified the four uses of standardized testing to be instructional, guidance, administrative, and research. The authors examined the criticisms of standardized testing in each of these areas, but recognized the value of using standardized assessment in schools as a measure of student achievement.

Phelps (2005) identified the three uses of standardized testing as diagnosis, selection, and motivation, and found that standardized testing can provide the motivation to change behaviors that lead to increased student achievement, and, therefore, higher test scores. Phelps staunchly

asserted that standardized testing is an accurate measure of student learning. Walberg (2012) also concluded that standardized tests are good measures of student achievement. To gather accurate data, teachers and administrators need to make sure they use standardized tests that are well-designed, create appropriate testing schedules and procedures, and provide adequate professional development for school staff charged with administering the tests.

Lauen and Gladdis (2012) examined the impact of the accountability movement using standardized testing on specific subgroups of students and whether this impact is affected by specific student and school characteristics. They used population-level administrative data from all students in grades three through eight in North Carolina between 2000 and 2008. The researchers examined whether the 2001 passage of the No Child Left Behind Act impacted the data gathered through standardized testing because the law included a new requirement that school districts disaggregate their data based on specific subgroups of students. The authors examined whether accountability pressure served to increase achievement scores of identified subgroups in order to identify the effect of educational policy decisions on student test scores. Data were collected on 1.7 million students in grades three through eight from 1,800 schools. The researchers found that the accountability pressure created by the requirement to examine the data of specific subgroups of students positively affected student test outcomes. The authors supported using high-stakes assessment in an effort to gather accurate data about student learning.

Steedle and Grochowalski (2017) examined the use of high stakes testing as a way to collect accurate data about student knowledge. Standardized testing is used to inform educators about student mastery of content standards. In order for the tests to give accurate information, to be valid, they have to be taken with intention. The high stakes nature of the standardized testing

for accountability provides motivation to students to demonstrate their actual learning so that the information gained from the testing data is accurate and can be reliably used to inform school level and policy decisions. The authors compared low-stakes and high-stakes testing data collected from students in grade nine in a southern state during the years of transition from low stakes testing to high stakes testing. The curriculum and testing procedures remained constant during the transition. The data were examined by creating matched samples of students from the low-stakes and high-stakes administrations using specific student characteristics to approximate randomly equivalent groups. Student performance was higher across all subject areas on the high-stakes testing administration. The authors indicated adding stakes to a testing situation resulted in an accurate measure of student knowledge.

Deming et al. (2016) examined how the results of the standardized testing scores in Texas were affected by accountability pressures. They compared test scores of successive grade cohorts in the same school from 1996 to 2002 and found the motivation to attend to standardized test scores provided to low-performing schools resulted in students significantly improving their scores on a tenth grade high-stakes math test. The researchers found the students were more likely to earn more math credits, graduate from high school on time, attend and graduate from a four-year college, and achieve higher earnings at age 25 than their peers in higher performing schools. The researchers concluded there are teacher behaviors or teaching practices that can be utilized to improve student outcomes and that standardized test scores accurately reflect student achievement. However, the authors also identified variations in the effects of accountability pressure associated with standardized testing. They concluded the accountability pressure applied to schools in the study had mixed results, providing the most benefit to students in schools that were most at risk of receiving a failing grade. They suggested educational policy

that supports a minimum standard of quality may provide more equitable results.

These findings were consistent with those of Nichols et al. (2014). These researchers analyzed the relationship between accountability pressure and the National Assessment of Educational Progress (NAEP) outcomes. The authors found that pressure was more robustly applied to students in low socioeconomic levels and in low performing schools. They found inconsistent effects of accountability pressure across subjects and over time. In general, accountability pressure effects on student performance on math assessment appeared to diminish over time, and to increase over time on student performance on reading assessment. The authors generally supported standardized assessment as an accurate measure of student learning outcomes, although they advised careful interpretation of assessment results.

Standardized Assessment and School Improvement

While there has been controversy about using standardized assessment data to measure student learning, researchers have demonstrated that standardized tests do accurately measure student knowledge. The use of standardized tests to measure teacher quality has also been debated by researchers (Wang et al., 2006). The development of value-added statistical modeling allowed for more accurate identification of teacher impact on student achievement. However, these statistical models have been criticized for lacking stability in their estimates of teacher quality (Baker et al., 2010; Hawley, et al., 2017; Sloat, et al., 2018). These researchers cautioned against using results from value-added models as the basis for high stakes teacher evaluation or personnel decisions. Policy makers acknowledged the controversy surrounding the use of student test scores in teacher evaluations mandated by NCLB. The 2015 Every Student Succeeds Act (ESSA) removed the mandate to use standardized test scores for teacher evaluation purposes,

allowing state education leaders flexibility to reconsider their approach to teacher evaluations (Darling-Hammond, 2016; Paufler & Clark, 2019).

An additional identified use of standardized assessment data is establishing the effectiveness of school improvement initiatives. In the era of educational accountability initiated by early educational policy and extended through NCLB and later ESSA, school leaders and educational policy makers are asked to justify school improvement expenditures, often through the use of standardized achievement data. Somers, et al. (2011) indicated that standardized assessments are a cost-effective way to estimate intervention impacts on general student achievement and that impact findings can be compared across grades and states. Wang et al. (2006) examined the benefits and difficulties with using standardized assessment data for decision making in education. They indicated that, when implemented with fidelity, standardized assessments provide accurate data that can be used for the monitoring and evaluating of educational policy initiatives and reform efforts. They endorsed the use of value-added statistical modeling to further identify school-level effects on student learning, and stressed the need to use collected data to evaluate policy initiatives implemented in schools.

Other researchers have discussed the use of standardized tests as school improvement tools. Beaver and Weinbaum (2015) found that school-level use of state-mandated standardized test data included use of the data to guide school-level improvement, such as curriculum alignment and professional development efforts. They interviewed teachers and administrators from 11 elementary and secondary schools in Pennsylvania to investigate the ways these practitioners made use of the data from state-mandated achievement testing. The researchers found that standardized testing data was used by participants in the study to identify and target specific learning needs of students and professional development needs of teachers. However,

the researchers reported that while school-level standardized test data can be used for school improvement purposes, not all study participants reported that their school or district level leaders used the data consistently for that purpose.

According to Schmidt and Burroughs (2016) using assessment to inform policy decisions can produce better school and district-level results than using assessment as policy for accountability purposes. Looney (2011) also stressed the need for large-scale assessment data to inform school-level decisions about resource allocation to support improvement in instructional strategies to address areas of need in student learning. While there is ongoing controversy around using standardized assessment as high stakes accountability, there is support for using the data to inform school and district level decision making about school improvement initiatives.

Impact of National Board Teacher Certification

The National Board for Professional Teaching Standards designed a teacher certification process based on standards that define what teachers should know and be able to do. The process of earning National Board certification emphasizes teacher knowledge and teaching practice. During the certification process, candidates identify their instructional behavior through analysis of video evidence of classroom teaching. Teachers are required to describe their practice and reflect on how their work demonstrates evidence of the standards of accomplished teaching. In addition, teachers submit and analyze student work samples and reflect on how their instructional practice advanced student learning as evidenced in the student work samples. Finally, teachers complete a rigorous assessment of content knowledge and pedagogy at a testing center (NBPTS, 2021a). National Board teacher certification earned through a demonstration of teaching performance and an assessment of content knowledge and pedagogy is a signal of teacher

quality, as an advance certification, and of teacher effectiveness, as accomplished teaching practice behaviors.

In order for National Board certification to be considered effective, it must impact the learning of the students. The third area of quality teaching identified by Goe (2007) is student outcomes, which researchers have argued can be effectively measured by standardized tests (Lauen and Gladdis, 2012; Phelps, 2005; Steedle & Grochowalski, 2017; Walberg, 2012). Therefore, to examine the effect of teacher quality identified as National Board certification on student achievement illustrated by standardized test scores, an examination of the test scores of students taught by teachers who have achieved National Board certification is needed.

National Board Teacher Certification and Student Assessment Scores

Several researchers have examined the impact of National Board teacher certification on student outcomes measured by standardized assessment scores. Cowan and Goldhaber (2016) analyzed student outcomes for 12,189 National Board certified teachers (NBCTs), comparing outcomes for students who did and did not have teachers with National Board certification. They found that NBCTs were more effective teachers than their non-certified peers. At the elementary level, they found NBCTs to be between .02 and .04 standard deviations more effective in math and reading than non NBCTs. At the middle school level, they found NBCTs to be .05 standard deviations more effective in teaching math and .01 standard deviations more effective in teaching reading than non NBCTs. The effects varied across groups and certificate areas.

Horoi and Bhai (2018) examined longitudinal data from North Carolina using multiple sources of variation. They examined assessment data for students in North Carolina and found that students taught by NBCTs achieved higher math and reading scores than students taught by non NBCTs. Students taught by NBCTs in third through eighth grade earned higher achievement

scores by .041 standard deviation in math and .012 standard deviation in reading. Their results were strengthened by including sibling and twin pairs and controlling for school fixed effects. To investigate spillover effects, they estimated the effects of having more NBCTs at a grade level on academic achievement of students taught by non NBCTs. They found no significant extraneous effects for non-certified teachers.

Researchers at the National Strategic Planning & Analysis Research Center (2017) reported that kindergarten and third grade students in Mississippi during the academic year 2015-2016 who were taught by NBCTs achieved higher test scores in reading than those taught by non NBCTs. The researchers used multilevel hierarchical regression to measure the relationship between having a National Board certified reading teacher and literacy ability as measured by the MKAS2-Kindergarten Readiness Assessment and the third grade Mississippi Assessment Program (MAP) test in English language arts. Their analysis indicated study participants in kindergarten who were taught by NBCTs were 5.1 percentage points more likely to achieve a proficient score on the MKAS2 reading test, and 1.8 percentage points more likely to realize performance growth on the MKAS2 reading test than peers who were not taught by NBCTs. Study participants in third grade who were taught by NBCTs were more likely by 10.7 percentage points to achieve a proficient score on the MAP assessment than students who were not taught by NBCTs.

Cavalluzzo et al. (2014) examined outcomes of secondary students in Kentucky and in the Chicago Public School District over four academic years (2007/08 through 2010/11 in Chicago and 2008/09-2011/12 in Kentucky). The researchers analyzed student standardized test scores in English, math, and science. They used scores from the Educational Planning and Assessment System (EPAS); they collected scores from the EXPLORE, PLAN, and ACT tests to

compare scores of students who had at least one NBCT in the subject area with scores of students who never had NBCTs. The researchers used scores from the EXPLORE as pretest and the PLAN as outcome measure for one analysis and scores from the PLAN as pretest and the ACT as outcome measure for the second analysis. There were 69,741 student participants for PLAN and 48, 546 participants for ACT in the Chicago sample. The Kentucky sample included 80, 490 student participants for PLAN and 114,465 participants for ACT. The researchers found that outcome measures for English, math, and science were higher for students who had at least one NBCT in the subject area compared to those of students who had never had NBCTs and the results were similar across schools and tested subjects. The differences were statistically significant for each grade level in each state ($p<.05$). This result provides support for the signaling effect of National Board certification; National Board certification may be a signal of teacher quality.

Curry et al. (2018) examined fourth grade reading achievement scores on the National Assessment of Educational Progress (NAEP) over six years for a nationally representative sample of students and schools from each state, the District of Columbia, and Department of Defense schools. They analyzed the potential impact of the teacher characteristics of NBC status, teacher preparation route, college major/minor, and degree earned on fourth-grade reading achievement. A significant statistical difference was reported among fourth-grade reading achievement scores for teacher variables of NBC status ($p<.001$), teacher preparation route ($p<.001$), and degree earned ($p<.05$). Interestingly, the researchers also found that students with teachers working toward National Board certification performed significantly lower than students with teachers who have earned or have not attempted National Board certification.

Manzeske et al. (2017) also found general positive effects of National Board teacher certification, although the effects were inconsistent across grade levels, subject areas, and participant subgroups. The authors analyzed assessment and behavioral outcomes of 112,408 fourth and fifth grade students in North Carolina and 97, 015 fourth and fifth grade students in Kentucky for the 2013-14 and 2014-15 school years. Data from North Carolina indicated there were no statistically significant effects on fourth and fifth grade student math and reading outcomes from being taught by NBCTs. Fifth grade students of NBCTs demonstrated a statistically significant higher attendance rate of .02 standard deviations compared to students of non NBCTs ($p < .05$). Data from Kentucky indicated students of NBCTs in fourth and fifth grade achieved statistically significant higher assessment scores of .06 standard deviations in reading and math compared to students of non NBCTs ($p < .05$). There were no statistically significant differences evident in behavior data of attendance and suspension for fourth and fifth grade students.

Belson and Husted (2015) studied a national sample of eighth grade math and reading scores on the National Assessment of Educational Progress (NAEP). NAEP is an educational achievement assessment administered by the National Center for Education Statistics (NCES) (U.S. Department of Education, 2018). It is the largest assessment project in the nation, dating from 1969. NAEP assesses a representative sample of students in schools across the country. NAEP results are reported for groups of students with similar characteristics and are used to compare the progress of students across districts, states, and nations in the assessed subjects of mathematics, reading, science, and writing. The results are also used by educators and policy makers to inform decisions regarding educational policy. Belson and Husted (2015) found that National Board teacher certification had significant positive effects on student reading and math

scores, indicating a positive and statistically significant correlation between the percentage of NBCTs who administered the NAEP in a state and average eighth grade math and reading NAEP scores of the state during the 2009 and 2011 assessment years ($p<.01$). They also found a negative and statistically significant relationship between the amount of NBCT concentration in a state and average eighth grade math and reading NAEP scores ($p<.01$). In states where NBCTs were concentrated in a small number of school districts, the average eighth grade NAEP scores were lower. These authors suggested there is a spillover effect from the collaboration among teachers within schools in states with more NBCTs and more widely distributed NBCTs that may have a positive effect on student standardized test scores. They stated that earlier research at the school level may not have been able to reveal these spillover effects and they called for more research about the relationship between National Board teacher certification and student outcomes at the individual student and school levels.

National Board Certification and Teacher Practice

Researchers have identified the teacher as a main contributor to student learning; therefore, school improvement efforts often target teacher practices and teacher capabilities through teacher professional development. For example, van Kuijk et al. (2016) demonstrated that teacher professional development focused on setting student learning goals, data use, and improving teacher knowledge of instructional strategies had a significant impact on the reading comprehension achievement of 430 second and third grade students in nineteen schools in the Netherlands whose teachers participated in the professional development program. The students of teachers involved in the professional development program gained more than a half year's growth over the students whose teachers were not involved in the program. High and low performing students gained equally from having teachers who participated in the professional

development program. Thurlings and den Brok (2017), in their meta-study of research on teacher professional development activities found evidence that well-designed professional development opportunities can be used to enhance teacher knowledge, teacher skills, and student learning.

NBCTs surveyed by researchers reported that their teaching practice was improved as a result of their participation in the National Board certification process (Petty et al., 2019). Researchers surveyed 496 NBCTs in North Carolina about their perceived growth on twenty teacher indicators and on the five core propositions developed by NBPTS. Participants reflected on their teaching before and after completing the NBC process by responding to items on a NB growth scale created by the authors. Survey results showed statistical significance in the areas of perceived improvement in categories of leadership opportunities and effective instruction. NBCTs surveyed indicated they used more effective instructional strategies, were more reflective, and worked with families more effectively as a result of completing the NB certification process. The NBCTs reported growth in each of the NBPTS five core propositions, and participant statements indicated greater ability to meet student academic needs, greater knowledge and effective use of curriculum, an increase in the use of progress monitoring to inform instruction, improved knowledge of students, and continued professional learning. The researchers called for more analysis of policy implications related to National Board certification in the areas of teacher retention, leadership, and student achievement.

Petty et al. (2016) analyzed the responses of 496 NBCTs in North Carolina to an open-ended survey question about how they perceived the National Board certification process had influenced student learning in their classrooms. Participant responses revealed themes of improved teaching, positive impact on students, and effective evaluation and assessment strategies. The surveyed NBCTs reported they responded better to student needs, differentiated

their instruction better, planned more engaging lessons, and communicated more effectively with parents. They also reported they were more effective at using formative assessment to guide instructional decisions and they had improved their ability to analyze student learning. They increased their use of reflection to evaluate their teaching and to improve their instruction. The NBCTs surveyed reported their students were more engaged in learning and, as a result, experienced improved learning and achieved higher standardized test scores after the teachers undertook the National Board certification process.

Cavalluzzo et al. (2014) conducted classroom observations of a sample of NBC candidate teachers and a sample of non-candidate teachers who had similar characteristics and similar classroom settings. Twenty-seven math and science teachers were observed in Kentucky and Chicago over three semesters. The teachers' use of effective instructional practices was evaluated through three 45-90-minute observations over three school semesters. The NBC candidate teachers were observed once in the semester they applied for the NBC process, once in the next semester during their NBC process, and once in the third semester of the NBC process. Non-candidate teachers were observed on the same schedule. The Leadership by Design classroom observation tool was used to collect information about 33 teaching practices organized in nine dimensions. Baseline observation data indicated NBC candidates scored statistically significantly higher than the non-applicant teachers on six of the nine subscales: lesson overview ($p<.05$), questioning ($p<.05$), content knowledge ($p<.1$), positive climate ($p<.05$), implements instruction ($p<.05$), and assesses learning ($p<.1$). Scores from the baseline observation were compared to scores from the subsequent two observations. Observation scores for the dimension classroom atmosphere indicated a statistically significant increase from the baseline observation to the second observation ($p<.05$). The change in score was maintained through the third

observation. The dimension classroom atmosphere included items of student involvement, classroom management, and classroom culture. No other statistically significant difference was found in the observation scores for either group of participants. The authors found National Board certification to be a signal of teacher effectiveness, but they did not find evidence that the certification increased teacher human capital. The authors explained this could be due to the fact that NBC teacher candidates participated in the study after they began the certification process, so their teaching practice may already have been impacted and this impact would therefore not be identified in the study data. The researchers pointed out the small sample size and relatively few observation events used to collect data. It is possible some effects of NBC candidacy were not identified during the study. The authors called for more research to examine the human capital effects of NB certification.

Kern et al. (2017) found that the National Board teacher certification process led to the development of a greater understanding of the connection between curriculum, pedagogy, and learning. An outcome of the NB certification process was the use of reflection to develop greater instructional effectiveness that improved student engagement and understanding. These authors reported that working collaboratively with peers during the National Board certification process was a valuable learning experience that improved their teaching practice. Houston and Kulinna (2019), however, observed physical education teachers and reported finding no difference between the teaching practices and decision-making processes of those with National Board teacher certification and those without certification during the course of three lessons in one instructional unit.

The teachers surveyed by Petty, et al. (2019) found the National Board certification process to be rewarding professional development. Other researchers have identified the National

Board certification process as a professional development opportunity for teachers. Ten NBCTs surveyed by Thomas (2016) reported that their teaching practice was changed as a result of the National Board teacher certification process. They reported feeling professionally empowered as a result of completing the National Board certification process. They also reported they became more collaborative in their professional practice. The National Board certification process was identified as powerful professional development that improved participants' practice; they became more reflective and analytical. Participants described the professional development of the National Board certification using terms such as teacher directed, invigorating, ideal, dynamic, empowering, collaborative, and reflective.

In other studies, NBCTs reported the National Board teacher certification process was an opportunity to receive mentoring and later to provide mentoring to others. Cress-Ackermann and Todorovich (2015) reported finding value in collaborating with peers while progressing through the National Board certification process and while mentoring others through the process. These authors created a "community of support and mentorship" while engaging in the National Board certification process (p. 37).

Belson and Husted (2015) studied a national sample of eighth grade math and reading scores on the National Assessment of Educational Progress (NAEP). They found a positive and statistically significant correlation between the percentage of NBCTs who administered the NAEP in a state and average math and reading NAEP scores of the state ($p<.01$). In addition, they found a positive and statistically significant correlation ($p<.01$) for NBCTs who participate in teacher collaborative or network activities and for NBCTs who participate in mentoring or peer observation activities. There was a positive relationship between NBC status and willingness to engage in leadership activities of mentoring and leading professional

development. The authors suggested that NBCTs can positively affect teaching and learning in schools through mentoring, peer observation, and professional training activities and that this may be the way effective teaching practice is shared within a school community.

Physical education teachers in South Carolina developed collaborative networks during their participation in the National Board certification process and those networks were maintained long after the end of the certification process. These NBCTs also reported that they included non-certified peers in their local collaborative networks, sharing professional information and instructional strategies (Rhoades & Woods, 2015). Researchers have identified characteristics of effective networks that include frequent interactions to support collaboration and inquiry that leads to enhanced professional capacity. Rincon-Gallardo and Fullan (2016) indicated the power of educator networks includes sharing resources and developing innovative ideas through collaboration.

Researchers have found that teachers who achieve National Board certification participate in leadership activities and opportunities related to their teaching. Jacques, et al. (2017) interviewed national and state teachers of the year. NBCTs in this group identified National Board teacher certification as highly valuable; they ranked it as one of their three most important professional experiences. Good, et al. (2016) analyzed the responses of 496 NBCTs in North Carolina to an open-ended survey question about perceived leadership opportunities resulting from earning National Board certification. Fifty-eight percent of the NBCTs surveyed reported engaging in various leadership opportunities in instruction, policy, and associations after achieving National Board teacher certification. Instructional leadership activities included providing professional development, mentoring new teachers and NB candidates, and serving on committees at the school, district, state, and community level. Association leadership activities

included committee membership and advocacy. Policy leadership activities included serving on advisory boards, visiting Capitol Hill, and working to advance the profession.

Swan Dagen et al. (2017) surveyed NBCTs who reported they engaged in all seven domains of the Teacher Leader Model Standards. Eighty-six percent of the 261 NBCTs surveyed identified themselves as leaders in their school. Teacher Leader Model Standard Domain 1: Fostering a collaborative culture to support educator development and student learning was the domain NBCTs reported engaging in most; they engaged it these activities weekly during the school year. NBCTs surveyed reported that collaboration was an important part of their professional practice as classroom teachers and as teacher leaders. Petty et al. (2019) connected teacher leadership opportunities to greater job satisfaction and lower staff attrition rates.

There is a growing teacher shortage in the United States that has been identified as a crisis situation (Garcia & Weiss, 2019). Researchers indicated there is a lower attrition rate among teachers who earn National Board certification (Center for Educator Recruitment, Retention, & Advancement, 2018). Cowan and Goldhaber (2016) stated school leaders should consider National Board certification when discussing teacher recruitment because NBCTs are more effective teachers. Cavalluzo et al. (2014) recommended that school and district leaders utilize the tool of National Board certification to recruit, retain, and reward teaching staff. Liang and Akiba (2015) found school districts that offer teacher pay incentives often provide those pay incentives to NBCTs and that larger school districts were more likely to provide teacher pay incentives as a recruitment and retention effort. Petty et al. (2016) recommended that school districts use support for National Board certification to recruit and retain high-quality teachers at high needs schools and also to develop a cohort of NBCTs in those schools. They indicated that policies encouraging NBCTs to work in high need schools or encouraging teachers in high need

schools to participate in the National Board certification process may improve learning outcomes for those students who could most benefit. Elfers and Plecki (2014) found that incentive policies in Washington were able to increase the number of NBCTs statewide and increase the proportion of NBCTs located in high needs schools. They found that NBCTS were less likely to leave the teaching profession. Cowan and Goldhaber (2018) also reported that school leaders in Washington were able to increase the number of NBCTs in high needs schools by using teacher pay incentives; however, they were not able to identify improvements in student achievement outcomes as measured by standardized assessments in those schools within the timeframe of the study.

The process of earning National Board teacher certification may have a positive effect on teacher efficacy, with NBCTs reporting greater confidence in their teaching practice (Thomas, 2016; Merz, 2017) as well as improved teaching practice in the areas of lesson planning, student engagement, instruction, evaluation and assessment, (Belson & Husted, 2015; Petty et al., 2016; Petty et al., 2019) and leadership activities (Cress-Ackermann & Todorovich, 2015; Good et al., 2016; Kern et al., 2017; Swan Dagen, 2017). Petty, et al. (2016) connected the five core propositions of the National Board certification process to the construct of teacher efficacy through reflective analysis of teaching practices that linked those practices to student learning.

The National Board teacher certification process can provide opportunities for teacher collaboration and mentoring behaviors. Mincu (2015) stated that the development of collective capacity can enhance the potential success of school improvement efforts. Rhoades and Woods (2015) found that the National Board certification process led to the creation of networked communities of practice among study participants. The sharing of expertise and professionalism

experienced by teachers through the National Board certification process may be a mechanism through which increased capacity can be realized across a school's teaching staff.

National Board Certification as Professional Development for School Improvement

Researchers investigating school improvement efforts have explored how professional development initiatives can be used as a mechanism for improving teacher quality and student learning outcomes. According to Cochran-Smith and Fries (2001), what is required to improve teaching quality is a school-level focus on alignment between standards and accountability and professional development offerings focused on improving student learning outcomes. Adolfsson and Hakansson (2019) identified four types of learning capital that reflect aspects of teacher and school capacity building in school improvement research. Human capital, social capital, program coherence, and resources represent areas of focus for capacity development in support of school improvement. Professional development initiatives that attend to these types of learning capital have the potential to improve school capacity and student outcomes.

Hopkins, et al. (2014) identified five historical phases in the school improvement field since the 1980s that illustrate a deep professional commitment to student learning. These researchers indicated that individual school capacity can be improved through a balance of accountability and innovation with a focus on improving the learning of all students. Movement through the historical phases has been marked by a growing understanding of the possibilities for professional development initiatives to increase capacity through opportunities for professional collaboration focused on improving student learning. This sentiment echoes earlier research by Fullan (2009), who discussed the research on school system reform and stressed the importance of having high quality teachers who are collaboratively focused on student learning and achievement.

Other researchers have stressed the importance of using professional development that targets the collective work of groups of educators to improve school capacity and school-wide student learning outcomes. According to Mincu (2015), the way to school improvement is through teacher quality and increased capacity with collaboration and reflection that includes analysis of student learning data. Benoliel and Berkovich (2016) agreed, stating that school improvement depends on collaborative teams of educators who are committed to a common vision of student learning. Yuan (2015) used value-added models to identify teacher spillover effects on student outcomes across core subject areas at the middle school level. This researcher specifically isolated participating teachers' influence on student achievement in another subject with another teacher. Findings indicate that mathematics teachers impacted student achievement in English language arts at grade seven and English language arts teachers impacted student achievement in mathematics at grade eight. English language arts teachers impacted student achievement in social studies at grade seven and social studies and science at grade 8. Social studies teachers impacted student achievement in science at grade eight. The researcher indicated the contributions to student learning of teachers at the middle school level may extend beyond the subject they teach. Sun et al. (2013) studied whether teachers were more likely to provide help to their peers if they participated in high-quality professional development and whether the expertise gained from professional development would spread to colleagues through helping interactions and change their instructional practices. They found that participation in professional development that was of longer duration, covered a larger range of instructional content, and included more active learning events significantly increased the number of colleagues teachers helped and the amount of help teachers provided to colleagues. The study design using

longitudinal data over a three-year time period allowed for examination of the way professional expertise can be accessed by greater numbers of teachers through professional interactions.

Dean and Jaquith (2015) interviewed principals at five schools located in different states. The interviews were used to collect data about the use of the NBPTS product Take One! to improve instruction in a school or department. School principals identified positive changes as a result of the use of the National Board certification process in the school. The positive changes included creating a safe and satisfying environment for teacher learning, increasing teachers' ability to see the relationship between their instruction and student learning, strengthening teachers' assessment skills, and refining their own teacher evaluation practices. In addition, principals in five schools identified increased student engagement along with, in three of the schools, improved student test scores. Principals interviewed also reported that teachers improved their ability to work effectively with parents during the course of the National Board certification process. These improvements were attributed to teachers' collective participation in the National Board *Take One!* product.

Jaquith, et al. (2016) surveyed and interviewed teachers in three schools in two districts during the 2013-2014 school year. The teachers were pursuing National Board teacher certification. The researchers provided mentoring support for the groups of teachers working on National Board certification in the three schools. The researchers documented the candidates work and the support they received from provided mentors. They collected field notes and recorded candidate conversations with the mentors. They found that teachers in the schools made significant changes to their instruction to improve student learning. They also found that teaching cultures in the schools were positively impacted by the collaborative professional learning undertaken by the National Board teacher candidates. Teachers in the study reported they

changed their practice through participating in the National Board certification process, through collaboration with colleagues in the project, and through the support received from the provided mentors. They reported they adjusted their instruction to better meet identified student needs, and the changes led to improved student learning. They also reported they developed stronger professional relationships. The principal in one school reported that the school culture was changed due to participating teachers being viewed as leaders, teacher collaboration becoming more focused on teaching and learning, and special education teachers initiating a change in service delivery for their students. The authors recommended policy initiatives to support the use of the National Board certification process as a school improvement strategy.

These studies demonstrated that teacher knowledge and expertise can be shared and extended among staff members through their interactions within the school setting. The National Board teacher certification process may have potential as a professional development initiative for increasing individual and collective capacity in schools. The changes to individual and collective teacher practice experienced in the schools in these studies improved the professional cultures within the schools and supported improved student outcomes. It was in the interactions between the professionals in the studies where increased capacity was manifested. Shirrell, et al. (2019) indicated that the professional interactions between teachers is most effective when it is focused on instruction through a structured professional development program. The National Board certification process may offer an opportunity to provide structure to professional interactions for the purpose of expanding professional capacity among teachers.

Summary

The era of high stakes assessment has brought attention to teacher quality in an effort to identify opportunities for improving student achievement scores. Since it is evident that teachers have a significant effect on student outcomes, research efforts have focused on identifying characteristics of quality teachers (König & Pflanzl, 2016; Cheng & Zamarro, 2018). Teacher quality has been examined through teacher credentials and teaching behaviors (Palacios, 2017; Skourdoumbis, 2017a). The National Board for Professional Teaching Standards created the National Board teacher certification process to identify and acknowledge accomplished teachers. The certification process requires teachers to demonstrate that their teaching exemplifies what accomplished teachers should know and be able to do (NBPTS, 2020a). There are currently 128,551 National Board certified teachers in the United States, representing about 3% of the nation's teachers (NBPTS, n.d.b.).

The impact of National Board teacher certification on student outcomes at the individual student level has been examined by several researchers (Cowan & Goldhaber, 2016; Horoi & Bhai, 2018; National Strategic Planning & Analysis Research Center, 2017) and at the state level using national testing data (Belson & Husted, 2015). Researchers have documented changes to teaching practice experienced by NBCTs as a result of the National Board certification process (Kern et al., 2017; Petty et al., 2016, 2019). Researchers also found that NBCTs self-identified as leaders in their schools and were engaged in leadership and mentoring activities, and that this professional behavior was impacted by participation in the National Board certification process (Belson & Husted, 2015; Cress-Ackermann & Todorovich, 2015; Good et al., 2016; Swan Dagen, 2017). Researchers found that NBCTs experienced the National Board certification process as professional development (Good et al., 2016; Pyle, 2014; Thomas, 2016) and as an

opportunity for collaboration with peers (Swan Dagen, 2017; Thomas, 2016; Kern et al., 2017; Rhoades & Woods, 2015). Finally, researchers have demonstrated that the National Board certification process can be used as professional development for teachers in order to expand professional capacity (Dean & Jaquith, 2015; Jaquith, et al., 2016). The National Board certification process may offer possibilities for school improvement through collaborative professional development that enhances teaching and leadership skills in order to improve student learning. Collaboration among teachers within a school has been shown to increase capacity through the spillover or diffusion of professional knowledge and instructional strategies (Sun et al., 2013; Yuan, 2015). More research is needed around the relationship of National Board teacher certification and school-level student learning outcomes. This study will add to the knowledge base by examining whether greater numbers of National Board certified teachers on a school staff have an impact on school-level standardized test scores.

CHAPTER THREE: METHODS

Overview

Chapter Three contains an explanation of the methods used to determine whether a greater number of National Board certified teachers on a school staff has an effect on school capacity as measured by school-level value-added growth scores in English language arts and mathematics reported on school accountability report cards. The research design, participants, null hypotheses, instrumentation, data collection procedures, and data analysis procedures are identified and explained in this chapter.

Design

This study used a quantitative, *ex post facto* causal-comparative methodology design to examine the mean differences between the variables of percentage of teachers on a school staff holding National Board teacher certification and school-wide growth scores in English language arts and mathematics. Quantitative methods are used when researchers employ statistical analysis procedures to examine data sets to compare variables, identify relationships between variables, or to predict how one variable will change in relation to another (Check & Schutt, 2012). Data were gathered from the Wisconsin Information System for Education (WISEdash) database and from the National Board Certified Teacher Directory. The independent variable of percentage of National Board certified teachers on a school staff was calculated by dividing the number of National Board certified teachers on the school staff by the total number of teachers on the staff during the 2018-2019 school year. National Board certified teachers were defined as teachers who have completed the National Board certification process successfully and have achieved National Board teacher certification. Selected elementary, middle, and high schools were organized in groups of schools with low percentage (0-3%) of National Board certified teachers

on staff, medium percentage (3-7%) of National Board certified teachers on staff, and high percentage (greater than 7%) of National Board certified teachers on staff. The percentage categories used in this study are similar to the percentage categories used by Knoeppel (2008) to examine the relationship between National Board certified teachers and student achievement in schools in Kentucky.

School-level growth in English language arts and mathematics were defined as the growth scores reported on Wisconsin accountability report cards for individual schools for the 2018-2019 school year. The dependent variable of school-level growth scores in English language arts and mathematics was collected from the Wisconsin accountability report cards through the WISEdash data archive.

A causal-comparative research design was employed to compare mean scores of variables of the percentage of National Board certified teachers on staff and school-level growth scores in English language arts and mathematics. Causal-comparative research designs are used to identify differences between groups by using inferential statistics to analyze how independent variables affect dependent variables (Gall et al., 2007). This research design can illuminate relationships between independent and dependent variables by comparing groups of data. A causal-comparative research design is an alternative to experimental design. It is an effective design to use in situations where the variables cannot be manipulated (Mertler, 2019). Because the independent variable in this study is categorical, consisting of naturally-occurring groups, it is not possible to assign random groups. Causal-comparative research designs are often used to study research questions in education. Researchers have used causal-comparative study design to examine teacher quality and student standardized test scores (Curry et al., 2018).

National Board certified teachers were defined as teachers who have completed the National Board certification process successfully and have achieved National Board teacher certification. The percentage of National Board certified teachers on a school staff was calculated by dividing the number of National Board certified teachers on staff by the total number of teachers on staff. English language arts growth scores were defined as the value-added scores calculated to indicate the difference between predicted and actual growth over time of students with similar characteristics in English language arts skills assessed by the standardized assessments in the Wisconsin Student Assessment System. Mathematics growth scores were defined as the value-added scores calculated to indicate the difference between predicted and actual growth over time of students with similar characteristics in mathematics skills assessed by the standardized assessments in the Wisconsin Student Assessment System.

For scores of students in grades 4 through 8, value-added growth scores in English language arts and mathematics are calculated from the Forward Exam scores. For students in grades 9 through 11, the Wisconsin value-added calculation combines converted ACT Aspire and ACT with Writing scores to calculate growth scores in English language arts and mathematics. Wisconsin Forward, ACT Aspire, and ACT with Writing scores are transformed to z-statistic scores using statewide means and standard deviations of test scores in English language arts and mathematics. Indicators for student gender, race/ethnicity, economic disadvantage, limited English proficiency, and disability are assigned to the data. The value-added model compares a student's performance to other characteristically similar students using prior year test scores and controlling for demographic characteristics (Meyer & Christian, 2019). The calculated value-added scores are converted to growth scores for English language arts and mathematics, which are combined on a 100-point scale and reported on the school accountability

report cards for individual schools (Office of Educational Accountability, 2019b). School-level growth scores in English language arts and mathematics are reported on Wisconsin accountability report cards for individual schools.

Research Questions

The research questions for this study are:

RQ1: Are there differences in the English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

RQ2: Are there differences in the mathematics growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

RQ3: Are there differences in the English language arts growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

RQ4: Are there differences in the mathematics growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

RQ5: Are there differences in the English language arts growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

RQ6: Are there differences in the mathematics growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

RQ7: Are there differences in the English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

RQ8: Are there differences in the mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

Hypotheses

The null hypotheses for this study are:

$H_0$1: There is no statistically significant difference in school-level English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$2: There is no statistically significant difference in school-level mathematics growth scores between schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

$H_0$3: There is no statistically significant difference in school-level English language arts growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$4: There is no statistically significant difference in school-level mathematics growth scores between elementary schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

$H_0$5: There is no statistically significant difference in school-level English language arts growth scores between middle schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$6: There is no statistically significant difference in school-level mathematics growth scores between middle schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

$H_0$7: There is no statistically significant difference in school-level English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$8: There is no statistically significant difference in school-level mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

Participants and Setting

The participants for the study were drawn from a stratified convenience sample of public schools located in Wisconsin. The 421 public school districts in the state of Wisconsin include 517 high schools, 347 middle schools, and 1,217 elementary schools. The 60,649 teachers in public schools in Wisconsin include 1,508 National Board certified teachers (NBPTS, n.d.b; Wisconsin DPI, 2018). A sampling frame was created for public schools in Wisconsin identified as elementary, middle, and high schools on their school report cards. Participant schools were selected from those listed in the sampling frame. Descriptive data, percentage of National Board certified teachers on staff, and academic growth scores for English language arts and mathematics for each selected school were added to a database used for the study analysis.

School staffing data were examined for the percentage of the teachers who have achieved National Board teacher certification. The school-wide growth scores in English language arts and mathematics drawn from Wisconsin accountability report cards were accessed through the WISEdash database. Public schools in Wisconsin report standardized assessment scores to the Wisconsin Department of Public Instruction (DPI). The data are entered into the WISEdash database by individual districts through the District Data Portal. The data are used to calculate school-level growth scores in English language arts and mathematics reported on Wisconsin accountability report cards. School-level growth scores from Wisconsin accountability report cards from the 2018-2019 school year were used for this study.

The public schools sampled for this study included 161 public schools, which exceeds the required minimum of 126 when assuming a medium effect size for a one-way ANOVA with statistical power of 0.7 at the 0.05 alpha level (Gall et al., 2007). The sample for this study included 53 elementary schools, 48 middle schools, and 60 high schools. Participant schools were identified as elementary, secondary, or high schools based on the designation reported on the school accountability report cards. The student population of the participant schools in the study included 20,977 students in elementary schools, 26,640 students in middle schools, and 55,019 students in high school. The student population in the participant schools included 915 students identified as American Indian, 5,153 students identified as Asian, 10,315 students identified as Black or African American, 11,517 students identified as Hispanic/Latino, 99 students identified as Native Hawaiian or Other Pacific Islander, 71,234 students identified as White, and 4,286 students identified as Two or More Races. The student population of participant schools included 14,354 students with disabilities, 37,791 students identified as

economically disadvantaged, and 5,197 English learners. The school-level academic growth scores in English language arts and mathematics comprised the dependent variable for the study.

The participant schools in the study employed 7,688 teachers, including 388 teachers holding National Board teacher certification. The teachers in the participant schools included 2,533 males and 5,150 females. Participant schools were staffed by 3,689 teachers with bachelor's degrees, 3,762 teachers with master's degrees, and 58 teachers with 6-year specialist degrees or doctoral degrees. Teaching staff in participant schools included 1,658 teachers with 0-5 years of teaching experience, 1,383 teachers with 6-10 years of teaching experience, and 4,648 teachers with 11 or more years of teaching experience. The independent variable for the study was the percentage of National Board certified teachers on the staff of the participant schools. Participant schools were assigned to groups according to the percentage of NBCTs on staff; the group identified as low percentage included schools with 0-3% NBCTs on staff, the group identified as medium percentage consisted of schools with 3-7% NBCTs on staff, and the group identified as high percentage comprised schools with greater than 7% NBCTs on staff. See Appendices A, B, and C for demographic data about participant school students and staff.

Instrumentation

Instruments used in this study included the National Board teacher certification assessment and the Wisconsin Student Assessment System: Wisconsin Forward Exam, ACT Aspire, and ACT with Writing. The Wisconsin Forward Exam, ACT Aspire, and ACT with Writing are standardized assessments given to students in Wisconsin's public schools that satisfy accountability requirements established by state and federal guidelines (Wisconsin DPI, n.d.b). The Wisconsin Forward Exam is administered to students in grades 3 through 8, the ACT Aspire is administered to students in grades 9 and 10, and the ACT with Writing is administered to

students in grade 11. Forward Exam scores are used to calculate value-added growth scores in English language arts and mathematics for schools serving students in grades 3 through 8. ACT Aspire and ACT with Writing scores are combined using the Wisconsin value-added model to compute English language arts and mathematics growth scores in English language arts and mathematics for individual schools serving students in grades 9 through 11 (Meyer & Christian, 2020; Office of Educational Accountability, 2019a).

National Board Teacher Certification

The National Board for Professional Teaching Standards (NBPTS) designed a teacher certification process based on standards that define what teachers should know and be able to do (NBPTS, 2021a). To be eligible for the National Board certification process, teachers must have earned a bachelor's degree from an accredited college or university, must have completed three years of teaching or school counseling practice, and must have a valid state educator's license. The certification process can be completed in one to five years. The certification earned can be renewed every five years through a certification renewal process. During the certification process, teachers identify their instructional behavior through analysis of video evidence of classroom teaching. Teachers are required to describe their practice and reflect on how their work demonstrates evidence of the standards of accomplished teaching. In addition, teachers submit and analyze student work samples and reflect on how their teaching advanced student learning as evidenced in the student work samples. Finally, teachers complete a rigorous assessment of content knowledge and pedagogy at a testing center (NBPTS, 2021a).

Candidate submissions are scored by applying the NBPTS standards to candidate performances through the use of the component scoring rubrics. The certification process includes four components. The assessment center component assessing content knowledge

includes 45 selected response items and three constructed response items. The three portfolio components assess differentiation in instruction, teaching practice and learning environment, and effective and reflective practice. Portfolio components consist of written analysis of recorded practice and student work, analysis of selection and use of assessment tools based on collected data, and reflection on collaboration with other professionals and community members. On the selected response portion of Component 1, each correct answer is awarded one point. Incorrect answers are awarded zero points. The number of items answered correctly is converted to a score between 0 and 4.25, the rubric score scale. The conversion produces a score that is standardized across certificate areas and across all four components. The three constructed response items on Component 1 and the portfolios of Components 2, 3, and 4 are awarded points using a 12-point rubric score scale ranging from 0.75 to 4.25. Candidates are required to meet three score requirements to achieve National Board certification. They must achieve an average score of at least 1.75 on the selected response and created response items in Component 1. They must achieve an average score of at least 1.75 on the portfolios produced for Components 2, 3, and 4. Finally, they must earn a total weighted scaled score of at least 110. Candidates who meet all three score requirements have demonstrated an overall level of accomplished teaching practice and are awarded National Board teacher certification (NBPTS, 2021b).

The NBPTS provided a description of the field testing and scoring of component items process that is used to ensure a reliable, accurate, and fair scoring process (NBPTS, 2021b). National Board teacher certification has been used as evidence of teacher quality by researchers investigating student achievement factors (Belson & Husted, 2015; Cavalluzzo et al., 2014; Cowan & Goldhaber, 2018; Horoi & Bhai, 2018).

Percentages of National Board certified teachers on a school staff were calculated by

dividing the number of National Board certified teachers on the staff by the number of teachers on staff. Selected elementary, middle, and high schools were organized in groups of schools with low percentage (0-3%) of National Board certified teachers on staff, medium percentage (3-7%) of National Board certified teachers on staff, and high percentage (greater than 7%) of National Board certified teachers on staff. The percentage categories used in this study are similar to the percentage categories used by Knoeppel (2008) to examine the relationship between National Board certified teachers and standardized achievement scores for students in schools in Kentucky.

Wisconsin Forward Exam

The Wisconsin Department of Public Instruction (DPI) partnered with Data Recognition Corporation (DRC) to develop a standardized assessment aligned to the Wisconsin Academic Standards (DRC, 2018). The assessment program is called the Wisconsin Forward Exam. Wisconsin Forward Exam reporting includes scale scores and performance levels. Reliability and validity measures for the Wisconsin Forward Exam were established in accordance with standards established by the American Educational Research Association, American Psychological Association, and National Council on Measurement in Education. Internal consistency was assessed for all items using Cronbach's alpha. Standard error of measurement was calculated for raw score and scale score. Reliability ranges from 0.88 to 0.90 across grades for English language arts and from 0.91 to 0.92 across grades for mathematics were reported.

Procedures for establishing validity of intended interpretation of test scores were reported through comparisons of the student performance on the Wisconsin Forward Exam with performance on the NAEP (DRC, 2018). Differences in percentages of students classified in different proficiency levels on the NAEP and Wisconsin Forward Exam were within 10% or less

for any performance level across grades and content areas. School-level assessment results for the Wisconsin Forward Exam are reported in grade level scale scores and school-wide performance levels. Student growth scores are also reported at the student level and at the school level. Growth scores in English language arts and mathematics are included in the school-level growth score reported on Wisconsin accountability report cards. English language arts and mathematics growth scores were used as the dependent variable in this study.

Researchers have used results from standardized tests in state assessment systems to document student achievement or growth in identified academic subject areas to examine the impact of selected factors on student outcomes. The Wisconsin Forward Exam was first administered to students in 2016; there has been limited research using data generated by this assessment. Reimer Rothmeyer (2020) used Wisconsin Forward Exam scores to identify high performing schools in Wisconsin for the purpose of identifying optimal standardized testing environments. Cowan and Goldhaber (2016) analyzed student outcomes on state-mandated standardized tests in Washington to compare outcomes of students who were taught by NBCTs and students who were not taught by NBCTs. Horoi and Bhai (2018) also used state-mandated standardized test scores to examine the impact of National Board teacher certification on student learning outcomes in North Carolina.

ACT Aspire

Wisconsin high school standardized assessments include the ACT Aspire assessment for students in grades 9 and 10. ACT Aspire is a summative assessment that measures what students have learned in the areas of English, reading, math, science, and writing. ACT Aspire results are reported on a 3-digit score scale and are compared to ACT Benchmarks to determine whether students are on track to meet college-ready benchmarks. The ACT Aspire English language arts

score and the mathematics score are included in the calculated school and district growth scores on the Wisconsin accountability report cards.

For English, mathematics, reading, and science, results of the raw score reliability based on multiple operational test forms administered in the 2017–2018 academic year were reported (ACT, Inc., 2020a). The range of the raw score reliability estimates for each testing mode per subject and grade were computed; test data from grades 9 and 10 were combined to evaluate the early high school (EHS) forms. Across grades, test forms for EHS had the highest reliability estimates regardless of test subjects. In general, science test forms had the highest reliability estimates among all the subjects. Scale score reliability and SEM for the four ACT Aspire subject tests were reported. Across online and paper testing modes, the ranges of SEM for one mode did not differ significantly from the ranges for another mode. Reported scale score reliability estimates were 0.95 or greater for all grades; they were also high for ELA and STEM scores, with values of 0.90 or greater.

As a validity measure, ACT Aspire predictive ability for performance in high school courses was examined (ACT, Inc., 2020a). To evaluate how well ACT Aspire scores predicted performance in high school courses, results from ACT's College Readiness Benchmarks research were used as points of reference. The logistic regression slope values were calculated using hierarchical logistic regression. Across 27 courses, the logistic regression slope ranged from 0.87 for dual-enrollment U.S. History courses to 1.87 for AP Human Geography courses. For all courses but one, the logistic regression slopes exceeded each B or higher ACT reference slope. This indicated the relationship between ACT Aspire test scores and high school course performance was generally stronger than the relationship between ACT test scores and college course performance. The average logistic regression slopes for the B or higher criterion were

compared across student subgroups. The predictive strength of ACT Aspire scores varied by subgroup, but ACT Aspire scores were strong predictors of success in high school courses for all subgroups.

Reid and McKenzie (2018) used ACT Aspire scores to identify high-growth schools in Arkansas to examine factors that may impact student learning growth in high-growth schools. Allen et al. (2019) related ACT Aspire scores to high school course grades in order to validate the predictive ability of ACT Aspire assessment items.

ACT with Writing

Wisconsin high school standardized assessments include the ACT with Writing, which is administered to students in grade 11 and consists of four multiple-choice tests: English, mathematics, reading, and science, as well as a 40-minute essay test that measures writing skills. The ACT English language arts and mathematics scores are included in the calculated school and district growth scores on the Wisconsin accountability report cards.

Reliability coefficients for the ACT with Writing were calculated using Cronbach's alpha (ACT, Inc. 2020b). Scale score reliability estimates and SEM for the ACT English, mathematics, reading, science, composite, STEM, and ELA scores were estimated at values over 0.90 for English, mathematics, composite, STEM, and ELA scores, and values over 0.80 for reading and science. SEM values were found to be consistent across test forms.

A correlation coefficient was used to summarize the results of predictive validity studies of the ACT exam using an examination of the linear relationship between first-year college grades or GPAs and admission or placement measures (ACT, Inc. 2020b). Because the ACT was designed to predict success in college, the assessment tasks were designed to match the content and cognitive demands of the associated academic subject. Students' performance on the ACT

was shown to be related to the high school courses they took and to their performance in the courses. Registrants for the ACT provided information about 30 high school courses in English, mathematics, social studies, natural sciences, languages, and arts. These courses represent a high school college-preparatory curriculum and are often required for college admission. In the study sample, academic factors accounted for the most variance explained in all five ACT scores (*R2* = 0.28 to 0.46). High school GPA, course work taken, and school characteristics comprised 64% to 77% of the total variance explained by the models. Noncognitive characteristics explained an additional 4% to 7%. No more than 4% of additional variability was explained by student demographic characteristics; this indicated that differential performance on the ACT among student demographic groups was attributable to differential academic performance.

Cavalluzzo et al. (2014) examined ACT scores of high school students in Kentucky and Chicago to identify the impact of National Board teacher certification on student achievement. They compared standardized assessment scores of students who had one or more NBCTs with those of students who did not have NBCTs and demonstrated a statistically significant difference across grade levels and subject areas.

Value-Added Growth Scores

As required by the Wisconsin state accountability system, the Wisconsin Department of Public Instruction (DPI) produces annual report cards for each public school and district in the state (Wisconsin DPI, n.d.a.). The accountability report cards include data on multiple indicators for multiple years across four priority areas (Office of Educational Accountability, 2019a). One priority area is growth in the academic areas of English language arts and mathematics. The accountability report cards include growth scores for English language arts and mathematics for

individual schools and for school districts. The growth scores indicate the rate of improvement in student performance over time in the academic areas of English language arts and mathematics.

The Wisconsin value-added model produced school-level measures for grades 3 through 11 in English language arts and mathematics using three years of score results as multiple lags (Meyer & Christian, 2019). For scores of students in grades 3 through 8, value-added growth scores in English language arts and mathematics are calculated from the Forward Exam scores. The Wisconsin value-added calculation combines converted ACT Aspire and ACT with Writing scores to calculate growth scores in English language arts and mathematics for schools serving students in grades 9 through 11. Wisconsin Forward, ACT Aspire, and ACT with Writing scores are transformed to z-statistic scores using statewide means and standard deviations of test scores in English language arts and mathematics. Indicators for student gender, race/ethnicity, economic disadvantage, limited English proficiency, and disability are assigned to the data. The value-added model compares a student's performance to other characteristically similar students using prior year test scores and controlling for demographic characteristics. Value-added models compare predicted growth to actual growth over time. The value-added model allows for the standardization of test scores across grades to enable comparisons of growth between grades and across schools and districts.

The calculated value-added scores are converted to growth scores for English language arts and mathematics, combined on a 100-point scale, and reported on the school accountability report cards for individual schools (Office of Educational Accountability, 2019b). Three years of value-added scores were used to calculate the growth scores reported on school and district accountability report cards for the 2018-2019 school year.

Value-added models have been used by researchers to identify student growth and to evaluate teacher, school, or program effectiveness. Ready (2013) compared accountability measures using value-added models and concluded that using value-added models that measured student learning rather than student achievement provided more accurate measures of school quality. Yuan (2015) used value-added models to examine teacher spillover effects on student outcomes across core subject areas at the middle school level. Chetty, et al. (2014b) used value-added modeling to estimate the impact of quality teachers on a range of long-term outcomes, including lifetime income.

Procedures

The data were collected following approval of the research plan by Liberty University's Institutional Review Board (IRB). See the IRB approval letter in Appendix D. The National Board for Professional Teaching Standards (NBPTS) maintains a directory of teachers who have achieved National Board certification. The National Board Certified Teacher (NBCT) directory is accessible to the public on the National Board for Professional Teaching Standards website, nbpts.org. Information about the number of teachers employed in selected public schools was accessed from the All Staff Report on the Wisconsin Department of Public Instruction (DPI) website. This information is reported to Wisconsin DPI annually by individual school districts through the WISEdash for Districts data portal and is accessible to the public. The percentage of NBCTs on staff in selected schools was determined by dividing the number of NBCTs employed in the school by the number of instructional staff identified on the Wisconsin DPI All Staff Report for the individual school. Selected elementary, middle, and high schools were organized in groups of schools with a low percentage (0-3%) of National Board certified teachers on staff,

a medium percentage (3-7%) of National Board certified teachers on staff, and a high percentage (greater than 7%) of National Board certified teachers on staff. These percentage categories are similar to the categories used by Knoeppel (2008) to examine the relationship between National Board certified teachers and student achievement scores for students in schools in Kentucky.

School-level value-added growth scores for English language arts and mathematics reported on Wisconsin accountability report cards were accessed from the WISEdash database. The value-added growth scores were calculated from standardized assessment data reported to Wisconsin DPI by individual school districts through the WISEdash for Districts data portal. These data are accessible to the public. Data was gathered from Wisconsin accountability report cards downloaded from the WISEdash database and recorded in an electronic file using codes for individual schools to protect anonymity. Collected data was securely stored in a password-protected electronic file to be removed after five years, as recommended by Creswell and Creswell (2018).

Data Analysis

Eight tests of analysis of variance (ANOVA) were used to examine the mean differences between the independent variable of percentages (low, medium, high) of National Board certified teachers on a school staff and the dependent variable of school-level growth scores in English language arts and mathematics reported on the Wisconsin accountability report cards. One-way analysis of variance (ANOVA) is used to test for differences in the mean scores of a continuous dependent variable and the categorical groups of an independent variable (Mertler, 2019). This analysis allowed for a comparison of mean differences between the variables in order to establish whether it is possible to reject the null hypotheses posed in this study.

For the purposes of this study, participant schools were assigned to groups based on the percentage of teachers on staff holding National Board certification. A total of three groups were created for the study: group 1 contained schools with a low percentage (0 to 3%) of National Board certified teachers on staff (N=60); group 2 contained schools with a medium percentage (3 to 7%) of National Board certified teachers on staff (N=55); group 3 contained schools with a high percentage (greater than 7%) of National Board certified teachers on staff (N=46).

After the data were collected, parametric statistical procedures were used to examine potential differences between the groups. In addition, mean and standard deviation of school-level growth scores in English language arts and mathematics were computed. These descriptive statistics were reported for the entire participant sample and for each school type group (elementary, middle, high). The school group served as the independent variable and the school-level growth scores in English language arts and mathematics served as the dependent variable for the purpose of conducting eight individual one-way ANOVA tests. ANOVA is a statistical test used to compare the amount of between-groups variance in specific scores with the amount of within-groups variance (Gall et al., 2007).

The null hypotheses were examined by comparing mean growth scores in English language arts and mathematics for school groups defined by percentage of National Board certified teachers on staff, with group 1 containing schools with a low percentage (0 to 3%) National Board certified teachers on staff, group 2 containing schools with a medium percentage (3 to 7%) National Board certified teachers on staff, and group 3 containing schools with a high percentage (greater than 7%) National Board certified teachers on staff. Eight one-way tests of analysis of variance (ANOVA) were performed to determine if a significant difference occurred

between at least one of the groups. Because significant results were identified, post hoc discriminant analyses were performed to determine differences between individual groups.

Data Screening

The collected data were sorted and examined for unusual scores and inconsistencies. Then the data were checked for outliers using a Box and Whisker plot for each group. A Box and Whisker plot is used to identify outliers that may be suppressed in the beginning stages of the data analysis process (Warner, 2013).

Assumptions for Analysis of Variance

There were several assumptions that needed to be examined when analyzing data for this study. First, the level of measurement was investigated; the dependent variable was measured on an interval scale. A continuous dependent variable is appropriate for statistical testing of analysis of variance (Gall et al., 2007). The use of a stratified convenience sample to select participants for the study satisfied the assumption of random sampling (Warner, 2013).

The observations within each variable were demonstrated to be independent because the incidence of one measurement provided no information about the incidence of the other measurement (Warner, 2013). The Kolmogorov-Smirnov and the Shapiro-Wilk tests were used to test for normal population distributions in the study sample. These tests indicate whether the frequency distribution of the data differed significantly from a normal distribution (Gall et al., 2007). Levene's Test of Equality of Error Variances was used to test the assumption that the population distributions had the same variances (Warner, 2013).

Results

Eight one-way tests of analysis of variance (ANOVA) were used to conduct statistical analysis on the collected data. *F* ratio was computed for the null hypotheses. The null hypotheses were determined to be significant ($p<.05$); therefore, post hoc analysis was conducted. A Tukey post hoc method was used to test sub null hypotheses. The effect size was reported as eta squared, η^2. Eta squared represents an explanation of variance (Warner, 2013).

Summary

The quantitative, causal-correlative study design was discussed in Chapter Three. The research questions and null hypotheses were listed. The participants and setting, 161 schools in a midwestern state, were described. The instrumentation and procedures for data collection were described. Procedures for data analysis were also described, including the independent and dependent variables, data screening, assumptions, and the statistical tests used. Results obtained from the statistical analysis of the collected data are reported in Chapter Four. These reported findings are discussed in Chapter Five along with the implications of the findings and recommendations for further study.

CHAPTER FOUR: FINDINGS

Overview

The purpose of this study was to explore whether there is a difference in school-level standardized assessment outcomes of schools with greater numbers of National Board certified teachers on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level growth scores in English language arts and mathematics. The independent variable included three levels. Participant schools were assigned to groups based on the percentage of NBCTs on staff; the group designated low percentage included schools with 0-3% NBCTs on staff; the group designated medium percentage included schools with 3-7% NBCTs on staff, and the group designated high percentage included schools with greater than 7% NBCTs on staff. Schools were assigned to school type groups according to the designation recorded on the school report card (elementary, middle, high). Eight one-way analysis of variance (ANOVA) tests were used to test the hypotheses. This chapter includes the research questions, null hypotheses, data screening, descriptive statistics, assumption testing, and results.

Research Questions

The research questions for this study are:

RQ1: Are there differences in the English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

RQ2: Are there differences in the mathematics growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

RQ3: Are there differences in the English language arts growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

RQ4: Are there differences in the mathematics growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

RQ5: Are there differences in the English language arts growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

RQ6: Are there differences in the mathematics growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

RQ7: Are there differences in the English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

RQ8: Are there differences in the mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

Hypotheses

The null hypotheses for this study are:

$H_0$1: There is no statistically significant difference in school-level English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$2: There is no statistically significant difference in school-level mathematics growth scores between schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

$H_0$3: There is no statistically significant difference in school-level English language arts growth scores between elementary schools with a low, medium, or high percentage of National

Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$4: There is no statistically significant difference in school-level mathematics growth scores between elementary schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

$H_0$5: There is no statistically significant difference in school-level English language arts growth scores between middle schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$6: There is no statistically significant difference in school-level mathematics growth scores between middle schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

$H_0$7: There is no statistically significant difference in school-level English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

$H_0$8: There is no statistically significant difference in school-level mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

Descriptive Statistics

Descriptive statistics were obtained for the dependent variable of English language arts and mathematics growth scores for the entire participant sample, for each group of percentage of NBCTs on staff (low, medium, high), and for each school type group (elementary, middle, high). The study sample consisted of 161 participant schools. See Table 1 and 2 for descriptive statistics.

Table 1

School-Level Growth Scores in ELA and Math by Percentage of NBCTs on Staff

Percent NBCTs on Staff		N	Minimum	Maximum	Mean	Std. Deviation
Low	ELA Growth Score	60	9.3	38.7	22.59	6.76
	Math Growth Score	60	9.3	41.6	22.48	7.43
	Valid N (listwise)	60				
Medium	ELA Growth Score	55	15.9	47.3	33.17	7.41
	Math Growth Score	55	13.1	48.2	32.37	8.36
	Valid N (listwise)	55				
High	ELA Growth Score	46	20.7	50.0	34.49	8.47
	Math Growth Score	46	18.8	48.2	34.08	7.67
	Valid N (listwise)	46				

Note: School-level growth scores in ELA and math reported are organized by percentage (low, medium, high) of NBCTs on staff.

Table 2

School-Level Growth Scores in ELA, Math by Percentage of NBCTs on Staff and School Type

Percentage NBCTs on Staff	School Type		N	Minimum	Maximum	Mean	Std. Deviation
Low	Elementary	ELA Growth Score	20	10.2	36.8	23.18	6.75
		Math Growth Score	20	10.2	41.6	23.95	8.78

		Valid N (listwise)	20				
	Middle	ELA Growth Score	18	14.0	38.7	23.04	6.28
		Math Growth Score	18	10.2	34.0	23.32	6.63
		Valid N (listwise)	18				
	High	ELA Growth Score	22	9.3	37.8	21.67	7.34
		Math Growth Score	22	9.3	38.7	20.46	6.53
		Valid N (listwise)	22				
Medium	Elementary	ELA Growth Score	18	15.9	47.3	33.17	7.51
		Math Growth Score	18	16.9	48.2	31.43	8.65
		Valid N (listwise)	18				
	Middle	ELA Growth Score	17	16.9	45.4	32.52	7.94
		Math Growth Score	17	19.7	44.4	31.46	7.05
		Valid N (listwise)	17				
	High	ELA Growth Score	20	21.6	43.5	33.73	7.19
		Math Growth Score	20	13.1	47.3	33.98	9.24
		Valid N (listwise)	20				
High	Elementary	ELA Growth Score	15	20.7	50.0	33.34	8.87
		Math Growth Score	15	19.7	48.2	33.35	8.78
		Valid N (listwise)	15				
	Middle	ELA Growth Score	13	23.5	50.0	33.22	7.86
		Math Growth Score	13	25.4	41.6	34.12	4.75
		Valid N (listwise)	13				
	High	ELA Growth Score	18	23.5	50.0	36.37	8.68
		Math Growth Score	18	18.8	48.2	34.66	8.68
		Valid N (listwise)	18				

Note: School-level growth scores in ELA and math reported are organized by percentage (low, medium, high) of NBCTs on staff and school type (elementary, middle, high).

Results

Results are reported according to the hypotheses addressed by analysis of each data group. Participant schools were identified as school type elementary, middle, or high on the state accountability report card. Results for the entire sample population are reported first, followed by results for each school type group (elementary, middle, high).

Null Hypothesis $H_0 1$

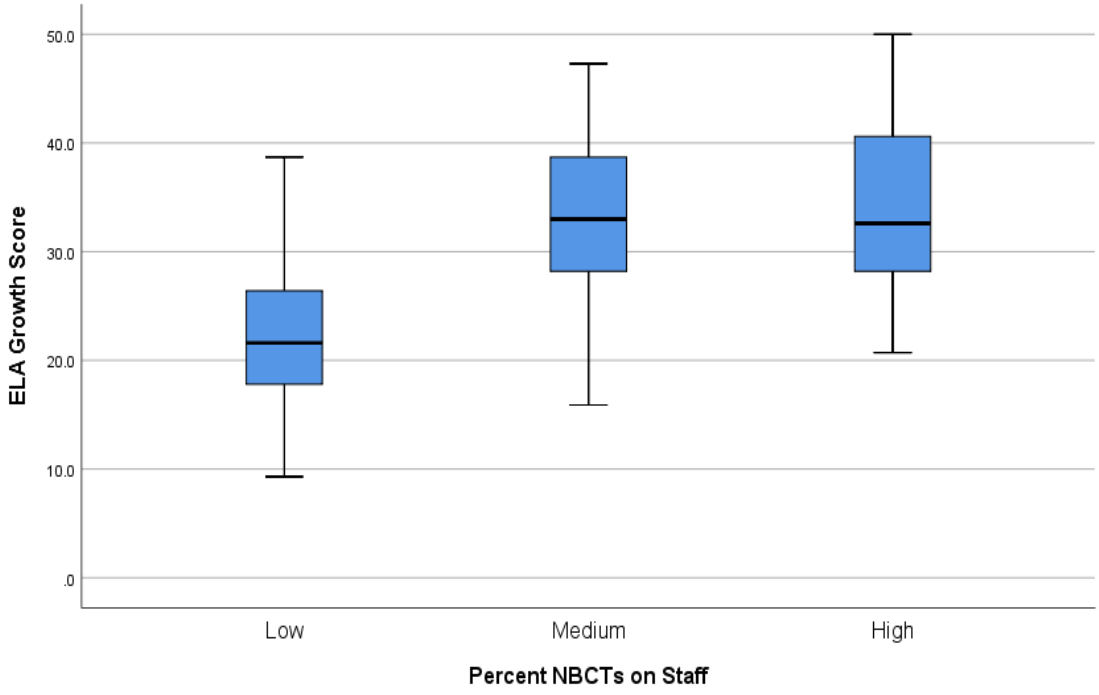
$H_0 1$: There is no statistically significant difference in school-level English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 1 for Box and Whisker plots.

Figure 1

Box and Whisker Plots – ELA Scores, School Type: All



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using the Kolmogorov-Smirnov test because the sample size was more than 50 participants. The assumption of normality was not met for all participant groups (low: p=.200; medium: p=.186; high: p=.011). The ANOVA is robust to violations of the assumption of normality when group sizes are roughly equivalent (Lix et al., 1996). See Table 3 for Tests of Normality.

Table 3

Tests of Normality – ELA Growth Scores, School Type: All

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
ELA Growth Score	Low	.082	60	.200*	.974	60	.240
	Medium	.106	55	.186	.976	55	.324
	High	.150	46	.011	.934	46	.012

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .093). See Table 4 for Levene's Test of Equality of Error Variances.

Table 4

Levene's Test of Equality of Error Variances[a,b] – ELA Growth Scores, School Type: All

		Levene Statistic	df1	df2	Sig.
ELA Growth Score	Based on Mean	2.416	2	158	.093
	Based on Median	2.066	2	158	.130
	Based on Median and with adjusted df	2.066	2	153.097	.130
	Based on trimmed mean	2.389	2	158	.095

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: ELA Growth Score

b. Design: Intercept + School_Category

Results

ANOVA tests were run to see if there was a difference in school-level English language arts growth scores for schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level English language arts growth scores. The researcher rejected null hypothesis $H_0 1$ at the 95% confidence level where $F(2, 158) = 42.28$, $p < .001$. Partial eta square equaled ($\eta^2_{part} = .349$). The effect size was medium. See Table 5 for Tests of Between-Subjects Effects.

Table 5

Tests of Between-Subjects Effects – ELA Growth Scores, School Type: All

Dependent Variable: ELA Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4756.173[a]	2	2378.087	42.276	.000	.349
Intercept	143941.038	1	143941.038	2558.873	.000	.942
School_Category	4756.173	2	2378.087	42.276	.000	.349
Error	8887.774	158	56.252			
Total	154747.150	161				
Corrected Total	13643.947	160				

a. R Squared = .349 (Adjusted R Squared = .340)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that schools with a medium percentage of NBCTs on staff (M = 33.17, SD = 7.41) and schools with a high percentage of NBCTs on staff (M = 34.49, SD = 8.47) reported statistically significantly higher school-level growth scores for English language arts than schools with a low percentage of NBCTs on staff (M = 22.59, SD = 6.76). There was no statistically significant difference found between schools with a medium percentage of NBCTs on staff and schools with high percentage of NBCTs on staff in the reported school-level growth scores for English language arts. See Table 6 for Multiple Comparisons.

Table 6

Multiple Comparisons – ELA Growth Scores, School Type: All

Tukey HSD Dependent Variable: ELA Growth Score

(I) Percent NBCTs on Staff	(J) Percent NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Low	Medium	-10.588*	1.4001	.000	-13.900	-7.275
	High	-11.908*	1.4698	.000	-15.386	-8.431
Medium	Low	10.588*	1.4001	.000	7.275	13.900
	High	-1.321	1.4985	.653	-4.866	2.225
High	Low	11.908*	1.4698	.000	8.431	15.386
	Medium	1.321	1.4985	.653	-2.225	4.866

Based on observed means.
The error term is Mean Square(Error) = 56.252.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$2

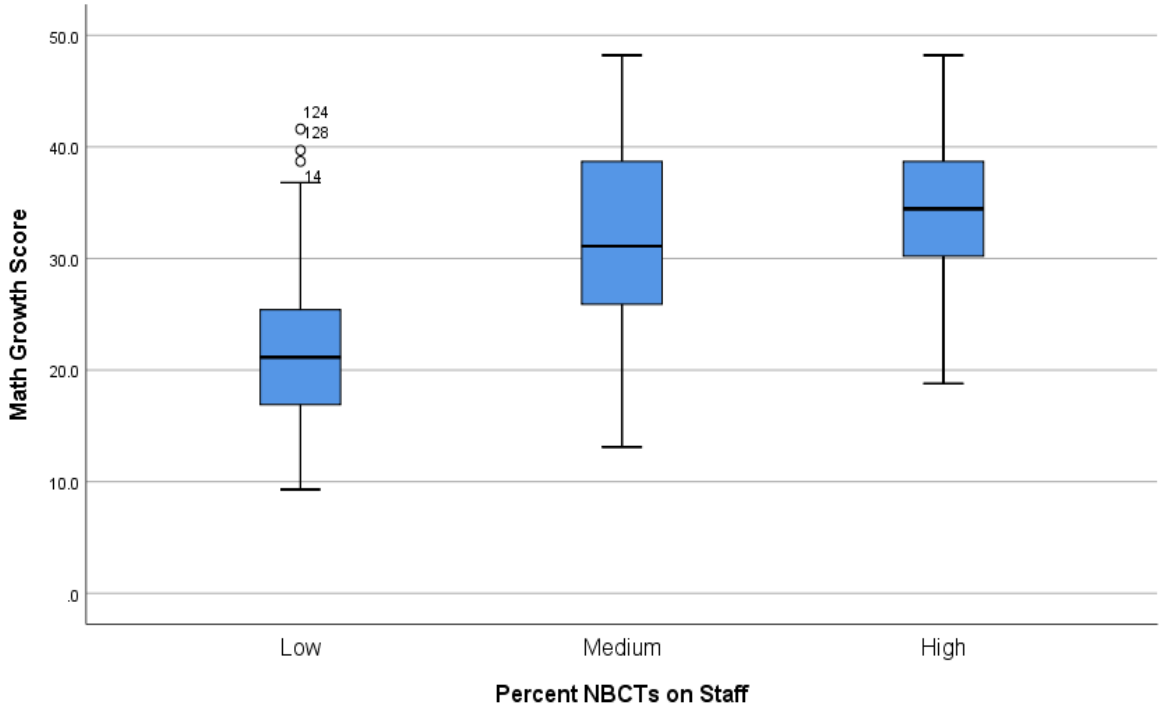
$H_0$2: There is no statistically significant difference in school-level mathematics growth scores between schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 2 for Box and Whisker plots.

Figure 2

Box and Whisker Plots – Math Growth Scores, School Type: All



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using the Kolmogorov-Smirnov test because the sample size was more than 50 participants. The assumption of normality was not met for all participant groups (low: p=.013; medium: p=.200; high: p=.200). The ANOVA is robust to violations of the assumption of normality when group sizes are roughly equivalent (Lix et al., 1996). See Table 7 for Tests of Normality.

Table 7

Tests of Normality – Math Growth Scores, School Type: All

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
Math Growth Score	Low	.130	60	.013	.964	60	.072
	Medium	.093	55	.200*	.976	55	.336
	High	.086	46	.200*	.977	46	.502

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .336). See Table 8 for Levene's Test of Equality of Error Variances.

Table 8

Levene's Test of Equality of Error Variances[a,b] - Math Growth Scores, School Type: All

		Levene Statistic	df1	df2	Sig.
Math Growth Score	Based on Mean	1.098	2	158	.336
	Based on Median	.984	2	158	.376
	Based on Median and with adjusted df	.984	2	157.269	.376
	Based on trimmed mean	1.124	2	158	.328

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: Math Growth Score.

Results

ANOVA tests were run to see if there was a difference in school-level mathematics growth scores for schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level mathematics growth scores. The researcher rejected null hypothesis $H_0 2$ at the 95% confidence level where $F(2, 158) = 35.57$, $p < .001$. ($\eta^2_{part} = .310$). The effect size was medium. See Table 9 for Tests of Between-Subjects Effects.

Table 9

Tests of Between-Subjects Effects – Math Growth Scores, School Type: All

Dependent Variable: Math Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4354.812[a]	2	2177.406	35.574	.000	.310
Intercept	139736.652	1	139736.652	2282.967	.000	.935
School_Category	4354.812	2	2177.406	35.574	.000	.310
Error	9670.921	158	61.208			
Total	151026.430	161				
Corrected Total	14025.733	160				

a. R Squared = .310 (Adjusted R Squared = .302)
b. Design: Intercept + School_Category

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that schools with a medium percentage of NBCTs on staff ($M = 32.37$, $SD = 8.34$) and schools with a high percentage of NBCTs on staff ($M = 34.08$, $SD = 7.67$) reported statistically significantly higher school-level growth scores for mathematics than schools with a low percentage of NBCTs on

staff (*M* = 22.48, *SD* = 7.43). There was no statistically significant difference found between schools with a medium percentage of NBCTs on staff and schools with a high percentage of NBCTs on staff in the reported school-level growth scores for mathematics. See Table 10 for Multiple Comparisons.

Table 10

Multiple Comparisons – Math Growth Scores, School Type: All

Tukey HSD Dependent Variable: Math Growth Score

(I) Percent NBCTs on Staff	(J) Percent NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	Medium	-9.887*	1.4605	.000	-13.343	-6.432
	High	-11.596*	1.5332	.000	-15.224	-7.968
Medium	Low	9.887*	1.4605	.000	6.432	13.343
	High	-1.709	1.5632	.520	-5.407	1.990
High	Low	11.596*	1.5332	.000	7.968	15.224
	Medium	1.709	1.5632	.520	-1.990	5.407

Based on observed means.
The error term is Mean Square(Error) = 61.208.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$3

$H_0$3: There is no statistically significant difference in school-level English language arts growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

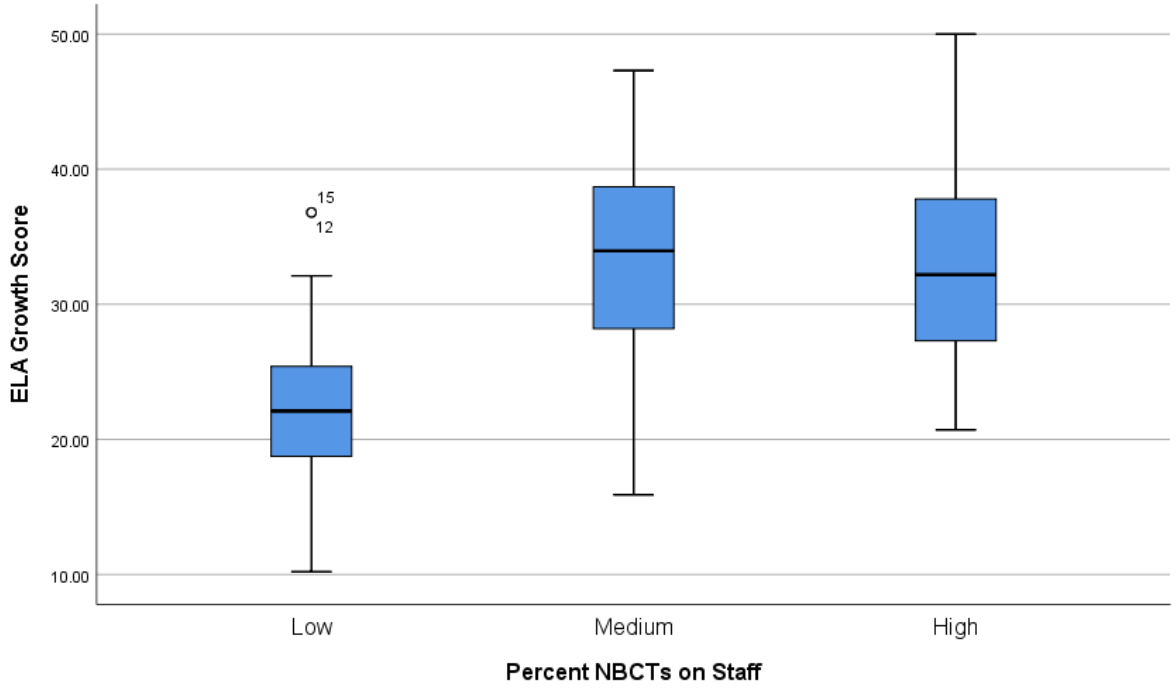
Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were

identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 3 for Box and Whisker plots.

Figure 3

Box and Whisker Plots – ELA Growth Scores, School Type: Elementary



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using the Kolmogorov-Smirnov test because the sample size was more than 50 participants. The assumption of normality was met for all participant groups (low: p=.129; medium: p=.200; high: p=.200). See Table 11 for Tests of Normality.

Table 11

Tests of Normality – ELA Growth Scores, School Type: Elementary

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
ELA Growth Score	Low	.171	20	.129	.953	20	.416
	Medium	.158	18	.200*	.958	18	.570
	High	.115	15	.200*	.960	15	.696

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .460). See Table 12 for Levene's Test of Equality of Error Variances.

Table 12

Levene's Test of Equality of Error Variances[a,b] - ELA Growth Scores, School Type: Elementary

		Levene Statistic	df1	df2	Sig.
ELA Growth Score	Based on Mean	.789	2	50	.460
	Based on Median	.672	2	50	.515
	Based on Median and with adjusted df	.672	2	48.853	.515
	Based on trimmed mean	.746	2	50	.480

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: ELA Growth Score
b. Design: Intercept + School_Category

Results

ANOVA tests were run to see if there was a difference in school-level growth scores for English language arts for elementary schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level English language arts growth scores. The researcher rejected null hypothesis $H_0$3 at the 95% confidence level where $F(2, 50) = 10.80$, $p < .001$. Partial eta square equaled ($\eta^2_{part} = .302$). The effect size was medium. See Table 13 for Tests of Between-Subjects Effects.

Table 13

Tests of Between-Subjects Effects – ELA Growth Scores, School Type: Elementary

Dependent Variable: ELA Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1263.882[a]	2	631.941	10.798	.000	.302
Intercept	46705.923	1	46705.923	798.035	.000	.941
School_Category	1263.882	2	631.941	10.798	.000	.302
Error	2926.310	50	58.526			
Total	50148.390	53				
Corrected Total	4190.192	52				

a. R Squared = .302 (Adjusted R Squared = .274)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that elementary schools with medium percentage of NBCTs on staff ($M = 33.17$, $SD = 7.51$) and elementary schools with high percentage of NBCTs on staff ($M = 33.34$, $SD = 8.87$) reported statistically significantly higher school-level growth scores in English language arts than elementary schools

with low percentage of NBCTs on staff (*M* = 23.18, *SD* = 6.75). There was no statistically significant difference found between elementary schools with medium percentage of NBCTs on staff and elementary schools with high percentage on NBCTs on staff in the reported school-level growth scores in English language arts. See Table 14 for Multiple Comparisons.

Table 14

Multiple Comparisons – ELA Growth Scores, School Type: Elementary

Tukey HSD Dependent Variable: ELA Growth Score

(I) Percent NBCTs on Staff	(J) Percent NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	Medium	-9.9972*	2.48551	.001	-16.0008	-3.9937
	High	-10.1650*	2.61305	.001	-16.4766	-3.8534
Medium	Low	9.9972*	2.48551	.001	3.9937	16.0008
	High	-.1678	2.67455	.998	-6.6279	6.2924
High	Low	10.1650*	2.61305	.001	3.8534	16.4766
	Medium	.1678	2.67455	.998	-6.2924	6.6279

Based on observed means.
The error term is Mean Square (Error) = 58.526.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$4

$H_0$4: There is no statistically significant difference in school-level mathematics growth scores between elementary schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

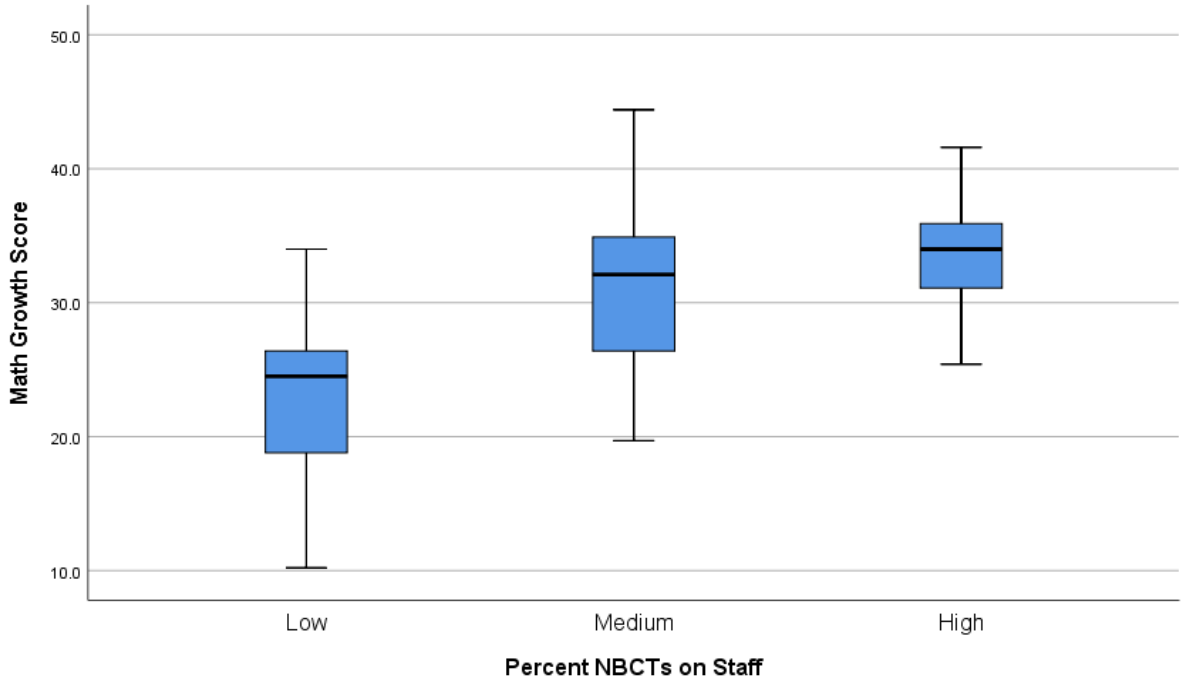
Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were

identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 4 for Box and Whisker plots.

Figure 4

Box and Whisker Plots – Math Growth Scores, School Type: Elementary



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using the Kolmogorov-Smirnov test because the sample size was more than 50 participants. The assumption of normality was met for all participant groups (low: p=.073; medium: p=.200; high: p=.200). See Table 15 for Tests of Normality.

Table 15

Tests of Normality – Math Growth Scores, School Type: Elementary

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
Math Growth Score	Low	.184	20	.073	.942	20	.261
	Medium	.158	18	.200*	.956	18	.518
	High	.148	15	.200*	.954	15	.585

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .944). See Table 16 for Levene's Test of Equality of Error Variances.

Results

ANOVA tests were run to see if there was a difference in school-level growth scores for mathematics for elementary schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level mathematics growth scores. The researcher rejected null hypothesis $H_0$4 at the 95% confidence level where $F(2, 50) = 5.89$, p =.005. (η^2_{part} = .191). The effect size was small. See Table 17 for Tests of Between-Subjects Effects.

Table 16

Levene's Test of Equality of Error Variances[a,b] – Math Growth Scores, School Type: Elementary

		Levene Statistic	df1	df2	Sig.
Math Growth Score	Based on Mean	.057	2	50	.944
	Based on Median	.041	2	50	.959
	Based on Median and with adjusted df	.041	2	48.371	.959
	Based on trimmed mean	.060	2	50	.942

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Math Growth Score

b. Design: Intercept + School_Category

Table 17

Tests of Between-Subjects Effects – Math Growth Scores, School Type: Elementary

Dependent Variable: Math Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	898.825[a]	2	449.413	5.885	.005	.191
Intercept	45714.268	1	45714.268	598.613	.000	.923
School_Category	898.825	2	449.413	5.885	.005	.191
Error	3818.347	50	76.367			
Total	49755.380	53				
Corrected Total	4717.172	52				

a. R Squared = .191 (Adjusted R Squared = .158)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that elementary schools with medium percentage of NBCTs on staff (M = 31.43, SD = 8.65) and elementary

schools with high percentage of NBCTs on staff (*M* = 33.98, *SD* = 9.24) reported statistically significantly higher school-level growth scores in mathematics than elementary schools with low percentage of NBCTs on staff (*M* = 23.95, *SD* = 8.78). There was no statistically significant difference found between elementary schools with medium percentage of NBCTs on staff and elementary schools with high percentage of NBCTs on staff in the reported school-level growth scores in mathematics. See Table 18 for Multiple Comparisons.

Table 18

Multiple Comparisons- Math Growth Scores, School Type: Elementary

Tukey HSD Dependent Variable: Math Growth Score

					95% Confidence Interval	
(I) Percent NBCTs on Staff	(J) Percent NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Low	Medium	-7.4833*	2.83918	.030	-14.3412	-.6255
	High	-9.3967*	2.98487	.008	-16.6064	-2.1869
Medium	Low	7.4833*	2.83918	.030	.6255	14.3412
	High	-1.9133	3.05512	.806	-9.2927	5.4661
High	Low	9.3967*	2.98487	.008	2.1869	16.6064
	Medium	1.9133	3.05512	.806	-5.4661	9.2927

Based on observed means.
The error term is Mean Square(Error) = 76.367.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$5

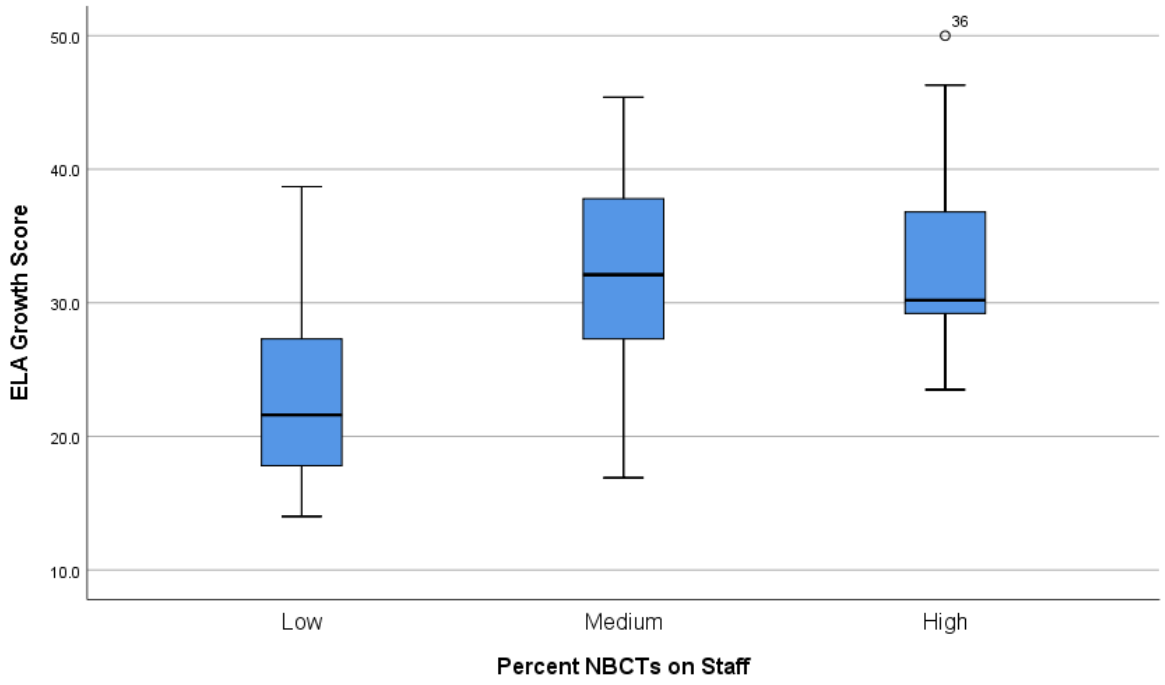
$H_0$5: There is no statistically significant difference in school-level English language arts growth scores between middle schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 5 for Box and Whisker plots.

Figure 5

Box and Whisker Plots – ELA Growth Scores, School Type: Middle



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using Shapiro-Wilk's test because the sample size was smaller than 50 participants. The assumption of normality was met for all participant groups (low: p=.285; medium: p=.959; high: p=.072). See Table 19 for Tests of Normality.

Table 19

Tests of Normality – ELA Growth Scores, School Type: Middle

	Percent NBCTs on Staff	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
ELA Growth Score	Low	.146	18	.200*	.940	18	.285
	Medium	.079	17	.200*	.980	17	.959
	High	.265	13	.013	.881	13	.072

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .602). See Table 20 for Levene's Test of Equality of Error Variances.

Table 20

Levene's Test of Equality of Error Variances[a,b] - ELA Growth Scores, School Type: Middle

		Levene Statistic	df1	df2	Sig.
ELA Growth Score	Based on Mean	.513	2	45	.602
	Based on Median	.388	2	45	.681
	Based on Median and with adjusted df	.388	2	40.019	.681
	Based on trimmed mean	.534	2	45	.590

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: ELA Growth Score
b. Design: Intercept + School_Category

Results

ANOVA tests were run to see if there was a difference in school-level growth scores for English language arts for middle schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level English language arts growth scores. The researcher rejected null hypothesis $H_0$5 at the 95% confidence level where $F(2, 45) = 10.04$, $p < .001$. Partial eta square equaled ($\eta^2_{part} = .309$). The effect size was medium. See Table 21 for Tests of Between-Subjects Effects.

Table 21

Tests of Between-Subjects Effects – ELA Growth Scores, School Type: Middle

Dependent Variable: ELA Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1080.139[a]	2	540.069	10.038	.000	.309
Intercept	41211.509	1	41211.509	766.007	.000	.945
School_Category	1080.139	2	540.069	10.038	.000	.309
Error	2421.018	45	53.800			
Total	44311.160	48				
Corrected Total	3501.157	47				

a. R Squared = .309 (Adjusted R Squared = .278)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that middle schools with medium percentage of NBCTs on staff ($M = 32.52$, $SD = 7.94$) and middle schools with high percentage of NBCTs on staff ($M = 33.22$, $SD = 7.86$) reported statistically significantly higher school-level growth scores in English language arts than middle schools with low

percentage of NBCTs on staff (*M* = 23.04, *SD* = 6.28). There was no statistically significant difference found between middle schools with medium percentage of NBCTs on staff and middle schools with high percentage on NBCTs on staff in the reported school-level growth scores in English language arts. Table 22 for Multiple Comparisons.

Table 22

Multiple Comparisons – ELA Growth Scores, School Type: Middle

Tukey HSD Dependent Variable: ELA Growth Score

(I) Percent NBCTs on Staff	(J) Percent NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	Medium	-9.479*	2.4807	.001	-15.491	-3.467
	High	-10.179*	2.6697	.001	-16.649	-3.708
Medium	Low	9.479*	2.4807	.001	3.467	15.491
	High	-.700	2.7024	.964	-7.249	5.850
High	Low	10.179*	2.6697	.001	3.708	16.649
	Medium	.700	2.7024	.964	-5.850	7.249

Based on observed means.
The error term is Mean Square(Error) = 53.800.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$6

$H_0$6: There is no statistically significant difference in school-level mathematics growth scores between middle schools with a with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

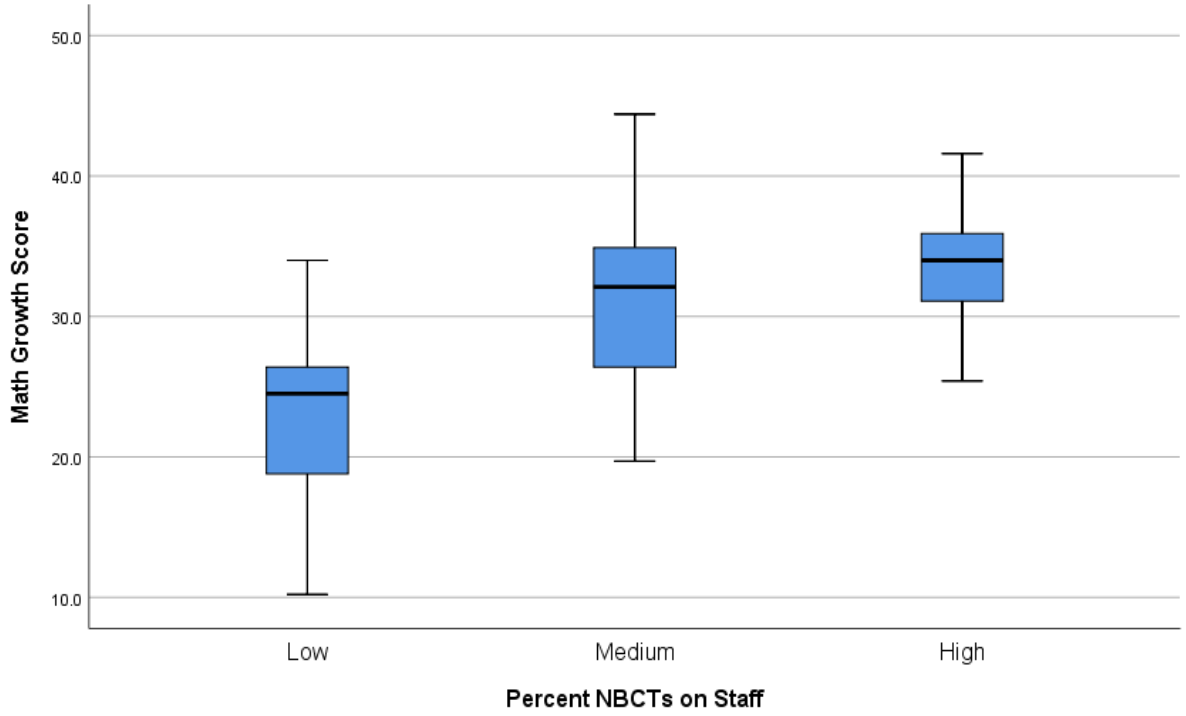
Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were

identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 6 for Box and Whisker plots.

Figure 6

Box and Whisker Plots – Math Growth Scores, School Type: Middle



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using Shapiro-Wilk's test because the sample size was smaller than 50 participants. The assumption of normality was met for all participant groups (low: p=.685; medium: p=.874; high: p=.590). See Table 23 for Tests of Normality.

Table 23

Tests of Normality – Math Growth Scores, School Type: Middle

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
Math Growth Score	Low	.182	18	.119	.964	18	.685
	Medium	.101	17	.200*	.973	17	.874
	High	.145	13	.200*	.949	13	.590

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .326). See Table 24 for Levene's Test of Equality of Error Variances.

Table 24

Levene's Test of Equality of Error Variances[a,b] - Math Growth Scores, School Type: Middle

		Levene Statistic	df1	df2	Sig.
Math Growth Score	Based on Mean	1.148	2	45	.326
	Based on Median	.893	2	45	.417
	Based on Median and with adjusted df	.893	2	41.641	.417
	Based on trimmed mean	1.121	2	45	.335

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: Math Growth Score
b. Design: Intercept + School_Category

Results

ANOVA tests were run to see if there was a difference in school-level growth scores for mathematics for middle schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level mathematics growth scores. The researcher rejected null hypothesis $H_0$6 at the 95% confidence level where $F(2, 45) = 12.70$, $p < .001$. ($\eta^2_{part} = .361$). The effect size was medium. See Table 25 for Tests of Between-Subjects Effects.

Table 25

Tests of Between-Subjects Effects – Math Growth Scores, School Type: Middle

Dependent Variable: Math Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1023.607[a]	2	511.803	12.702	.000	.361
Intercept	41304.225	1	41304.225	1025.132	.000	.958
School_Category	1023.607	2	511.803	12.702	.000	.361
Error	1813.123	45	40.292			
Total	43553.480	48				
Corrected Total	2836.730	47				

a. R Squared = .361 (Adjusted R Squared = .332)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that middle schools with medium percentage of NBCTs on staff ($M = 31.46$, $SD = 7.05$) and middle schools with high percentage of NBCTs on staff ($M = 34.12$, $SD = 4.75$) reported statistically significantly higher school-level growth scores in mathematics than middle schools with low percentage of NBCTs on staff ($M = 23.32$, $SD = 6.63$). There was no statistically significant difference found

between middle schools with medium percentage of NBCTs on staff and middle schools with high percentage of NBCTs on staff in the reported school-level growth scores in mathematics. See Table 26 for Multiple Comparisons.

Table 26

Multiple Comparisons – Math Growth Scores, School Type: Middle

Tukey HSD Dependent Variable: Math Growth Score

(I) Percent NBCTs on Staff	(J) Percent NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	Medium	-8.142*	2.1467	.001	-13.345	-2.939
	High	-10.799*	2.3104	.000	-16.398	-5.199
Medium	Low	8.142*	2.1467	.001	2.939	13.345
	High	-2.657	2.3387	.497	-8.325	3.012
High	Low	10.799*	2.3104	.000	5.199	16.398
	Medium	2.657	2.3387	.497	-3.012	8.325

Based on observed means.
The error term is Mean Square (Error) = 40.292.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$7

$H_0$7: There is no statistically significant difference in school-level English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in English language arts reported on school accountability report cards.

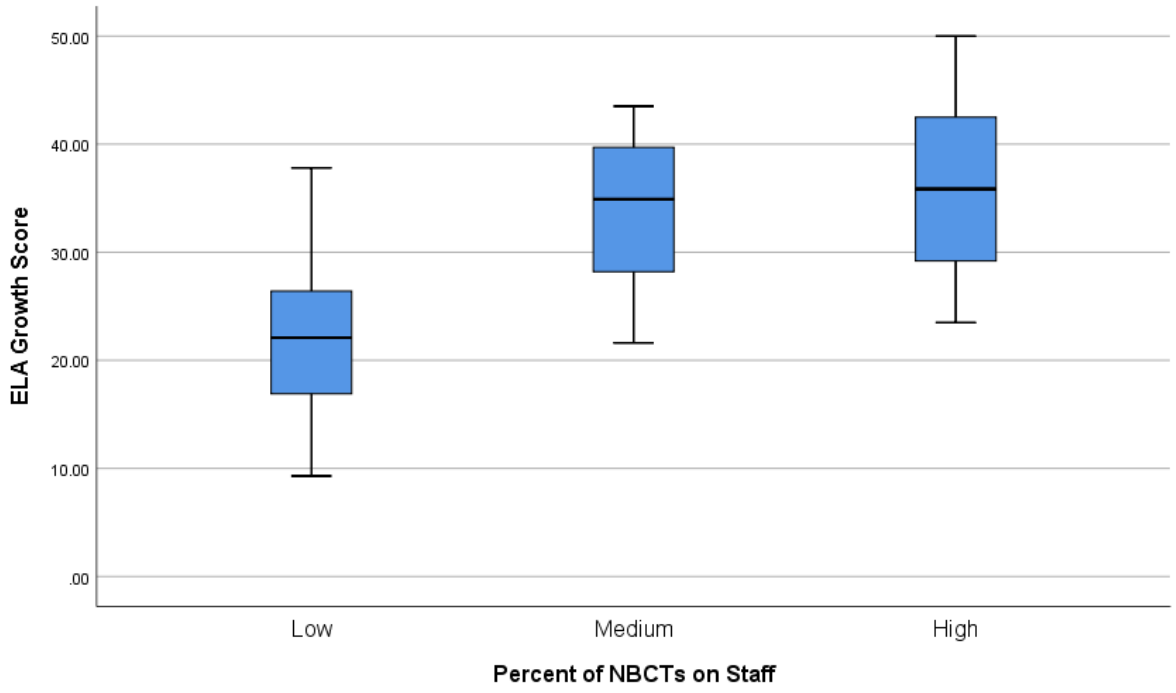
Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were

identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 7 for Box and Whisker plots.

Figure 7

Box and Whisker Plots – ELA Growth Score, School Type: High



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using the Kolmogorov-Smirnov test because the sample size was larger than 50 participants. The assumption of normality was met for all participant groups (low: p=.200; medium: p=.153; high: p=.200). See Table 27 for Tests of Normality.

Table 27

Tests of Normality – ELA Growth Scores, School Type: High

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent of NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
ELA Growth Score	Low	.085	22	.200*	.979	22	.904
	Medium	.166	20	.153	.912	20	.071
	High	.150	18	.200*	.927	18	.172

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .495). See Table 28 for Levene's Test of Equality of Error Variances.

Table 28

Levene's Test of Equality of Error Variances[a,b] – ELA Growth Scores, School Type: High

		Levene Statistic	df1	df2	Sig.
ELA Growth Score	Based on Mean	.711	2	57	.495
	Based on Median	.684	2	57	.509
	Based on Median and with adjusted df	.684	2	53.735	.509
	Based on trimmed mean	.703	2	57	.499

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: ELA Growth Score
b. Design: Intercept + School_Category

Results

ANOVA tests were run to see if there was a difference in school-level English language arts growth scores for high schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level growth scores for English language arts. The researcher rejected null hypothesis $H_0 7$ at the 95% confidence level where $F(2, 57) = 21.28$, $p < .001$. Partial eta square equaled ($\eta^2_{part} = .427$). The effect size was large. See Table 29 for Tests of Between-Subjects Effects.

Table 29

Tests of Between-Subjects Effects – ELA Growth Scores, School Type: High

Dependent Variable: ELA Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2533.363[a]	2	1266.681	21.275	.000	.427
Intercept	55769.274	1	55769.274	936.708	.000	.943
School_Category	2533.363	2	1266.681	21.275	.000	.427
Error	3393.637	57	59.537			
Total	60287.600	60				
Corrected Total	5927.000	59				

a. R Squared = .427 (Adjusted R Squared = .407)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that high schools with a medium percentage of NBCTs on staff ($M = 33.73$, $SD = 7.19$) and high schools with a high percentage of NBCTs on staff ($M = 36.37$, $SD = 8.68$) reported statistically significantly higher school-level growth scores in English language arts than high schools with a low

percentage of NBCTs on staff (*M* = 21.67, *SD* = 7.34). There was no statistically significant difference found between high schools with medium percentage of NBCTs on staff and high schools with a high percentage of NBCTs on staff in the reported school-level growth scores for English language arts. See Table 30 for Multiple Comparisons.

Table 30

Multiple Comparisons – ELA Growth Scores, School Type: High

Tukey HSD Dependent Variable: ELA Growth Score

(I) Percent of NBCTs on Staff	(J) Percent of NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	Medium	-12.0523*	2.38393	.000	-17.7890	-6.3155
	High	-14.6995*	2.45232	.000	-20.6008	-8.7982
Medium	Low	12.0523*	2.38393	.000	6.3155	17.7890
	High	-2.6472	2.50689	.545	-8.6799	3.3854
High	Low	14.6995*	2.45232	.000	8.7982	20.6008
	Medium	2.6472	2.50689	.545	-3.3854	8.6799

Based on observed means.
The error term is Mean Square(Error) = 59.537.
*. The mean difference is significant at the .05 level.

Null Hypothesis $H_0$8

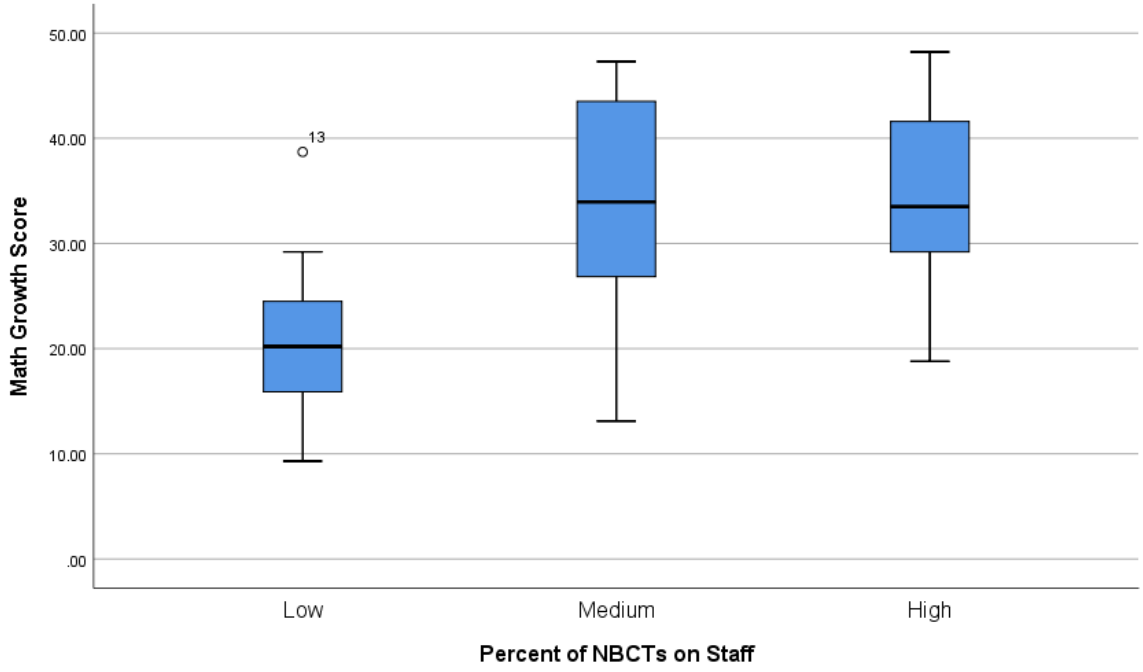
$H_0$8: There is no statistically significant difference in school-level mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers on staff as measured by value-added growth scores in mathematics reported on school accountability report cards.

Data Screening

Data screening was conducted on each group's dependent variable. The researcher sorted the data on each variable and scanned for inconsistencies. No data errors or inconsistencies were identified. Box and Whisker plots were used to detect outliers on each dependent variable. No outliers were detected. See Figure 8 for Box and Whisker plots.

Figure 8

Box and Whisker Plots – Math Growth Score, School Type: High



Assumption of Normality

The ANOVA requires that the assumption of normality be met. Normality was examined using the Kolmogorov-Smirnov test because the sample size was larger than 50 participants. The assumption of normality was met for all participant groups (low: p=.200; medium: p=.200; high: p=.200). See Table 31 for Tests of Normality.

Table 31

Tests of Normality – Math Growth Scores, School Type: High

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Percent of NBCTs on Staff	Statistic	df	Sig.	Statistic	df	Sig.
Math Growth Score	Low	.134	22	.200*	.954	22	.380
	Medium	.149	20	.200*	.938	20	.219
	High	.159	18	.200*	.962	18	.632

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Assumption of Homogeneity of Variance

The ANOVA requires that the assumption of homogeneity of variance be met. The assumption of homogeneity of variance was examined using Levene's test. The assumption of homogeneity of variance was met where (p = .062). See Table 32 for Levene's Test of Equality of Error Variances.

Table 32

Levene's Test of Equality of Error Variances[a,b] – Math Growth Scores, School Type: High

		Levene Statistic	df1	df2	Sig.
Math Growth Score	Based on Mean	2.921	2	57	.062
	Based on Median	2.853	2	57	.066
	Based on Median and with adjusted df	2.853	2	56.850	.066
	Based on trimmed mean	2.903	2	57	.063

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Dependent variable: Math Growth Score
b. Design: Intercept + School_Category

Results

ANOVA tests were run to see if there was a difference in school-level mathematics growth scores for high schools with a low (0-3%), medium (3-7%), or high (greater than 7%) percentage of NBCTs on staff. The independent variable was percentage of NBCTs on staff and the dependent variable was school-level growth scores for mathematics. The researcher rejected null hypothesis $H_0$8 at the 95% confidence level where $F(2, 57) = 20.06$, $p < .001$. (η^2_{part} = .413). The effect size was large. See Table 33 for Tests of Between-Subjects Effects.

Table 33

Tests of Between-Subjects Effects – Math Growth Scores, School Type: High

Dependent Variable: Math Growth Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2673.543[a]	2	1336.771	20.062	.000	.413
Intercept	52565.067	1	52565.067	788.893	.000	.933
School_Category	2673.543	2	1336.771	20.062	.000	.413
Error	3797.990	57	66.631			
Total	57717.570	60				
Corrected Total	6471.533	59				

a. R Squared = .413 (Adjusted R Squared = .393)

Because the researcher rejected the null, post hoc analysis was required. A Tukey post hoc test was performed to compare all possible pairs of group means among the three groups representing percentage of NBCTs on staff. Based on this test, it was found that high schools with a medium percentage of NBCTs on staff (M = 33.98, SD = 9.24) and high schools with a high percentage of NBCTs on staff (M = 34.66, SD = 8.68) reported statistically significantly higher school-level growth scores in mathematics than high schools with a low percentage of NBCTs on staff (M = 20.46, SD = 6.53). There was no statistically significant difference found

between high schools with a medium percentage of NBCTs on staff and high schools with a high percentage of NBCTs on staff in the reported school-level growth scores in mathematics. See Table 34 for Multiple Comparisons.

Table 34

Multiple Comparisons – Math Growth Scores, School Type: High

Tukey HSD Dependent Variable: Math Growth Score

(I) Percent of NBCTs on Staff	(J) Percent of NBCTs on Staff	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Low	Medium	-13.5209*	2.52196	.000	-19.5898	-7.4520
	High	-14.1965*	2.59431	.000	-20.4395	-7.9535
Medium	Low	13.5209*	2.52196	.000	7.4520	19.5898
	High	-.6756	2.65204	.965	-7.0575	5.7064
High	Low	14.1965*	2.59431	.000	7.9535	20.4395
	Medium	.6756	2.65204	.965	-5.7064	7.0575

Based on observed means.
The error term is Mean Square(Error) = 66.631.
*. The mean difference is significant at the .05 level.

Summary

Chapter Four provided a summary of the procedures for data collection and analysis. The data consisted of English language arts and mathematics growth scores for schools assigned to each category based on percentage of NBCTs on staff (low: 0-3%; medium: 3-7%; high: greater than 7%). The descriptive statistics were reported as well as the results from eight one-way ANOVA tests performed on the data. The results of the statistical analysis indicated a statistically significant relationship between the percentage of NBCTs on staff and school-level growth scores in English language arts and mathematics. The researcher performed Tukey post

hoc tests to examine differences between groups. The findings are discussed in Chapter Five, along with implications of the findings and recommendations for further research.

CHAPTER FIVE: CONCLUSIONS

Overview

This chapter includes a discussion of the results of the study that were presented in the previous chapter. The research questions are discussed relative to the study findings. Implications of the findings are presented, along with limitations of the study and recommendations for further research.

Discussion

The purpose of this quantitative, causal-comparative research was to establish whether there is a difference in school-level English language arts and mathematics growth scores between schools with low, medium, and high percentages of National Board certified teachers on staff. The independent variable of percentage of National Board certified teachers on a school staff was calculated by dividing the number of National Board certified teachers on the school staff by the total number of teachers on the staff during the 2018-2019 school year. National Board certified teachers were defined as teachers who have completed the National Board certification process successfully and have achieved National Board teacher certification. Selected elementary, middle, and high schools were organized in groups of schools with low percentage (0-3%) of National Board certified teachers on staff, medium percentage (3-7%) of National Board certified teachers on staff, and high percentage (greater than 7%) of National Board certified teachers on staff. The percentage categories used in this study are similar to the percentage categories used by Knoeppel (2008) to examine the relationship between National Board certified teachers and student achievement in schools in Kentucky.

School-level growth in English language arts and mathematics was defined as the value-added growth scores reported on Wisconsin accountability report cards for individual schools for the 2018-2019 school year.

The main research questions for this study were:

1. Are there differences in the English language arts growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

2. Are there differences in the mathematics growth scores between schools with a low, medium, or high percentage of National Board certified teachers?

The analysis of the data demonstrated there is a statistically significant difference between schools with low, medium, or high percentages of NBCTs on staff. The Tukey post hoc analysis revealed a statistically significant difference between the English language arts and mathematics growth scores of schools with a low percentage (0-3%) and schools with a medium percentage (3-7%) and high percentage (greater than 7%) of NBCTs on staff. No statistically significant difference was found between the English language arts and mathematics growth scores of schools with a medium percentage of NBCTs on staff and schools with a high percentage of NBCTs on staff.

Additional questions for this study were:

3. Are there differences in the English language arts growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

4. Are there differences in the mathematics growth scores between elementary schools with a low, medium, or high percentage of National Board certified teachers?

5. Are there differences in the English language arts growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

6. Are there differences in the mathematics growth scores between middle schools with a low, medium, or high percentage of National Board certified teachers?

7. Are there differences in the English language arts growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

8. Are there differences in the mathematics growth scores between high schools with a low, medium, or high percentage of National Board certified teachers?

The analysis of the data for each school type group (elementary, middle, high) revealed similar results with significant outcomes as the data for the entire participant study. For each school type group (elementary, middle, high), a statistically significant difference was found between the school-level growth scores in English language arts and mathematics of schools with a low percentage (0-3%) and schools with a medium percentage (3-7%) and high percentage (greater than 7%) of NBCTs on staff. English language arts and mathematics growth scores increased between schools with a medium percentage (3-7%) and schools with a high percentage (greater than 7%) of NBCTs on a school staff; however, the difference between the school-level growth scores in English language arts and mathematics of these two groups was not statistically significant. From the results of the current study, it is not clear the ideal percentage of NBCTs on staff that will realize the maximum effect on student growth scores, but the study results do indicate that the presence of greater numbers of NBCTs on a school staff may have an impact on student learning outcomes.

These results support previous studies in which researchers found students who were taught by NBCTs achieved statistically significantly higher achievement scores on standardized assessments (Belson & Husted, 2015; Cavalluzzo et al., 2014; Cowan & Goldhaber, 2016; Curry et al., 2018; Horoi & Bhai, 2018; Manzeske et al., 2017; National Strategic Planning & Analysis

Research Center, 2017). The study results also support the findings of Belson and Husted (2015) that greater numbers of NBCTs throughout a state correlated with higher student achievement scores in the state. The results of the current study align with the findings of Koeppel (2008), who found that greater numbers of NBCTs on a school staff correlated with higher scores on standardized achievement tests and that the correlation was statistically significant. Knoeppel found that school achievement scores were impacted when between 2% and 3% of the teachers on staff were NBCTs. That finding is similar to the results of the current study. English language arts and mathematics growth scores were found to be statistically significantly increased for schools with greater than 3% of NBCTs on staff. Knoeppel found that the increase in achievement scores leveled off when between 6% and 8% of the teachers on staff were NBCTs. This finding is also similar to the findings in the current study. Although achievement growth scores for English language arts and mathematics were higher for schools with a high percentage (greater than 7%) of NBCTs on staff than for schools with a medium percentage (3-7%) of NBCTs on staff, the difference was not statistically significant. The school-level growth scores appeared to level off when greater than 7% of teachers on staff were NBCTs.

The current study examined schools serving students in three school types (elementary, middle, high). The relationship between school-level academic growth scores in English language arts and mathematics and percentage of NBCTs on staff remained consistent across school type. This finding adds to the findings of previous studies because school-level assessment data across all grade levels of assessed students were examined. Previous studies focused on assessment data from specific school types and grade levels. Some researchers focused on elementary and middle grades (Cowan & Goldhaber, 2016; Horoi & Bhai, 2018), elementary grades 4 and 5 (Curry et al., 2018; Manzeske et al., 2017; National Strategic Planning

& Analysis Research Center, 2017), or secondary grades (Cavalluzzo et al., 2014). This study revealed consistent results across school types and grade levels of assessed students (grades 3 through 11).

The current study adds to the research base by supporting the findings of previous studies and extending the discussion of National Board teacher certification as a way to improve student learning outcomes. In addition, the current study examined school-level growth scores. The school-level growth scores were value-added growth scores calculated by comparing the academic growth of students with the academic growth of students with similar characteristics over three years. This adds an additional dimension of the contributions of NBCTs to student outcomes to the discussion. Increased rates of academic growth allow for achievement gap-closing possibilities in student learning and increase the value of National Board teacher certification as a school improvement initiative. Researchers have noted the unequal distribution of high quality teachers among schools and the critical need for high quality teachers in low performing schools (Cowan & Goldhaber, 2018; Elfers & Plecki, 2014; Petty et al., 2016). Petty et al. (2016) introduced the possibility of creating cohorts of National Board teacher candidates within high needs schools and Cavalluzo et al. (2014) recommended the use of National Board teacher certification by school and district leaders as a tool to recruit, retain, and reward teaching staff.

The correlation between higher academic growth for students and higher percentages of NBCTs on staff supports the premise that the framework of the National Board teacher certification process identifies accomplished teachers while allowing opportunities for teachers to collaborate in developing and expanding their accomplished practice. The correlation between higher academic growth for students and higher percentages of NBCTs on staff also supports the

premise that interactions among professional staff members provide an avenue for dissemination of professional knowledge across a school staff, thus increasing individual and collective capacity.

Social cognitive learning theory holds that learning happens in the interactions among person, behavior, and environment (Bandura, 1989), and that, through observing and interacting with others in their environment, individuals develop new or enhanced knowledge and skills. This process is recursive and ongoing, reinforced by cognitive processes and feedback from the environment as individuals act on new learning. Professional skill development and learning happens in the interactions among teacher colleagues in a school. The National Board teacher certification provides teachers with potential mastery experiences that support the development of teacher efficacy. Researchers have found that teacher efficacy supports student achievement (Bandura, 1989; Tschannen-Moran, et al., 1998; Zee & Koomen, 2016).

The process of earning National Board certification may provide mastery experiences that build teacher efficacy. In addition, several researchers have noted that NBCTs engage in other mastery experiences as a result of earning National Board certification. These experiences include leadership and mentoring (Belson & Husted, 2015; Good et al., 2016; Jacques et al., 2017; Swan-Dagen et al., 2017) as well as collaborating and networking (Cress-Ackerman & Todorovich, 2015; Rhoades & Woods, 2015), further extending the opportunity for professional interactions within which knowledge and skills may be disseminated among colleagues.

Colleagues share mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal in their interactions within the school as they work toward a common goal. Collective teacher capacity develops though this collaborative process. In those interactions is located the manifestation of individual and collective efficacy through the constructs identified

by Bandura (1993). As mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal are experienced among colleagues throughout a school community, collective efficacy expands, impacting school-level achievement outcomes (Bandura, 1993; Goddard, et al., 2000). Collective teacher efficacy has been identified as an agent of school improvement (Donohoo, 2018; Donohoo, et al., 2018).

Yuan (2015), using value-added models to isolate teachers' effects on student outcomes across core subject areas, demonstrated that teachers' contributions to student learning extends beyond the subject they teach. Sun et al. (2013) demonstrated that professional expertise can be accessed by greater numbers of teachers through professional interactions. The National Board teacher certification process is relevant professional development because it is based on a rigorous set of professional standards, and it is voluntary, job-embedded, and reflective, requiring a critical examination of teaching practice. The process advances individual accountability through its evaluative function and collective accountability through opportunities for collaboration. These are characteristics of effective professional development identified by researchers (Benoliel & Berkovich, 2016; Cochran-Smith & Fries, 2001; Kennedy, 2016; Lund, 2020; Mincu, 2015; Noonan, 2014; Sun et al., 2013). National Board teacher certification is a recognition of exemplary practice and accomplished teaching that offers a pathway to leadership opportunities and career development that function to extend professional expertise among school staff as well as to improve job satisfaction and staff retention. The knowledge and expertise resulting from participation in the National Board certification process may be distributed among teachers, including those who are not involved in the National Board certification process, or who have not yet become involved in the process.

The National Board teacher certification process has potential as a professional development initiative that may increase individual and collective capacity in schools. Researches have demonstrated that a structured and supported use of the National Board teacher certification process within schools has the potential to create changes in individual and collective teacher practice, improve the professional culture within the schools, and support improved student outcomes (Dean & Jaquith, 2015; Jaquith et al., 2016). Principals interviewed by Dean and Jaquith (2015) reported they refined their teacher evaluation practices as a result of supporting teacher candidacy in the National Board certification process. It was in the interactions between the professionals in these studies where increased individual and collective capacity was realized.

Implications

This study examined the connection between National Board teacher certification and school-level learning outcomes. The study results indicate a relationship exists between greater numbers of NBCTs on a school staff and higher school-level growth scores in English language arts and mathematics. The findings were consistent across all school types (elementary, middle, high).

The study findings support the idea that the complex tasks of teaching and learning are carried out through interactions among individuals within the teaching and learning environment. Within these interactions, individual and collective efficacy may expand through mastery experiences such as National Board certification, successful collaboration, leadership, mentoring, and the realization of student learning. Greater numbers of teachers focused on improving teaching practice working in collaboration may impact student learning outcomes by

strengthening and maintaining this recursive process.

Shirrell, et al. (2019) indicated that the professional interaction between teachers is most effective when it is focused on instruction through a structured professional development program. According to Nurul Azkiyah (2017), policy makers can provide enabling mechanisms to support school improvement efforts through structured professional development efforts. The National Board teacher certification process may provide an opportunity for structured professional development as a school improvement initiative.

The implication of the findings of the current study is not just that professional knowledge shared within the interactions between teaching staff can improve student learning, it is that school leaders have the opportunity to harness the process of the dissemination of knowledge by providing structure to those interactions. The National Board teacher certification process may offer a way to structure professional interactions in a way that expands professional capacity among teachers and improves student learning.

The National Board teacher certification process as a collaborative professional development initiative may have the potential to increase teacher and school capacity by distributing knowledge and expertise among a school staff through structured interactions among and between professionals as they interact with the National Board core propositions and content area standards on the journey to National Board certification.

Limitations

Causal-comparative research design is limited by lack of control, randomization, and manipulation because data is collected from naturally occurring groups that are already formed (Check & Schutt, 2012; Gall et al., 2007; Mertler, 2019). Findings should be carefully interpreted with consideration of extraneous variables and may not be generalizable to other

groups. This study was limited by the small sample size. There were 161 participant schools and 388 NBCTs involved in the study, a small sample of the schools in the state. The participant schools were all schools in one state; thus, the results of this study may not generalize to other states. In addition, the study examined school-level growth scores in English language arts and mathematics; these scores may not capture all areas of student learning impacted by NBCTs or by the professional interactions among teaching staff. The school-level growth scores that comprised the dependent variable for the study are value-added growth scores controlled for student characteristics including economic status, disability status, and English learner status. There may be other factors impacting student performance. Finally, the small number of categories created for the independent variable may have reduced the sensitivity of the data analysis to changes in school-level outcomes. A greater number of categories may have provided greater sensitivity to changes in school-level outcomes and possibly revealed a more exact framing of the critical amount of NBCTs on a school staff that would provide the greatest impact on student learning.

Recommendations for Future Research

Recommendations for further research include additional research investigating the effect of greater numbers of NBCTs in a school on school-level student learning outcomes. In addition, more research is needed to identify with greater accuracy the critical level of NBCTs needed to impact student learning outcomes. Additional research is also needed to explore the impact of NBCTs on learning outcomes at different grade levels, in different school types, and in different subject areas. Finally, further research is needed on the impact of supporting school and district cohorts of National Board teacher candidates.

Additional research in this area would help school leaders and educational policy makers to understand the best use of the National Board teacher certification process in order to realize the greatest impact of National Board teacher certification on school capacity manifested as student learning outcomes.

Summary

The findings of the study were discussed in Chapter Five. Findings were discussed as they related to current research and to implications for practice. The findings of this study aligned with other research and added to the discussion of the use of the National Board teacher certification process as professional development for school improvement to increase capacity in teachers and schools and improve student learning outcomes. Finally, limitations of the study were discussed along with recommendations for further research.

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Appendix A

Participant School Student Demographic Data

School	School Type	Student Count	% American Indian or Alaskan Native	% Asian	% Black or African American	% Hispanic/ Latino	% Native Hawaiian/ Other Pacific Islander	% White	% Two or More Races	% SWD	% Economically Disadvantaged	% English Learner
682	High	306	2.3	0.0	0.3	2.9	0.0	93.5	1.0	13.1	46.1	0.0
343	High	387	2.6	2.8	12.7	62.3	0.0	17.6	2.1	27.6	66.9	17.1
198	High	348	0.6	0.0	96.3	2.3	0.3	0.0	0.6	35.6	89.1	0.6
892	High	201	0.0	1.5	0.5	9.0	0.0	88.6	0.5	11.4	33.3	3.5
493	High	691	10.1	0.3	0.6	3.8	0.0	78.0	7.2	12.0	31.7	1.0
873	High	918	0.8	1.7	1.6	3.7	0.1	89.7	2.4	13.0	22.3	0.7
572	High	335	0.0	0.0	0.0	3.8	0.0	92.5	2.8	17.5	47.2	0.0
813	High	236	0.0	0.0	0.0	3.0	0.0	95.3	1.7	10.6	19.5	0.0
176	High	416	0.2	0.7	1.2	4.3	4.3	90.9	2.6	11.8	19.5	1.7
269	High	203	2.0	0.5	3.4	0.5	0.0	93.1	0.5	11.8	57.1	0.5
390	High	763	1.2	0.9	1.3	12.7	0.3	81.5	2.1	16.9	41.8	3.0
187	High	1545	1.1	7.1	36.4	42.8	0.0	10.6	2.0	24.7	79.1	15.7
793	High	1408	0.9	12.9	3.7	2.6	0.1	75.8	4.0	14.1	38.8	3.2
626	High	1561	0.4	5.4	21.1	25.3	0.0	36.6	11	18.7	55.2	17.4
901	High	715	0.0	1.0	1.3	7.8	0.0	86.9	3.1	11.6	33.3	1.1
235	High	1002	0.1	2.2	77.9	13.6	0.0	3.6	2.6	25	90.9	6.8
471	High	452	0.0	0.7	0.7	3.8	0.0	93.1	1.8	13.9	17.9	0.4
464	High	502	19.9	0.0	1.2	4.8	0.0	70.1	4.0	14.9	46.6	0.0
203	High	841	0.5	11.8	34.2	46.3	0.0	5.8	1.4	26.5	1.4	40.8
761	High	779	0.1	1.8	91	3.6	0.1	1.4	1.9	27.5	99.2	0.6
839	High	884	0.8	10.2	55.9	19.1	0.0	11.2	2.8	20.6	69.6	12.4
595	High	1626	0.4	4.1	5.0	11.9	0.1	74.5	4.1	10.5	37.5	5.7
986	High	1981	0.4	3.2	5.7	11.4	0.0	76.4	3.0	15.8	38.6	3.0
472	High	665	0.3	0.5	0.8	7.4	0.0	90.5	0.6	13.1	41.8	2.9
325	High	1155	0.2	7.4	1.3	1.0	0.3	88.0	1.7	15.5	25.5	2.4
716	High	379	0.5	0.5	1.1	0.5	0.0	97.1	0.3	12.4	34.3	0.3
446	High	1715	0.3	1.5	0.6	5.7	0.0	88.9	2.9	10.3	13.6	1.3
774	High	1298	0.2	12.3	3.5	5.6	0.2	73.8	4.3	8.5	7.6	0.8
570	High	1667	0.2	6.5	1.6	4.8	0.2	82.8	3.9	10.9	24.5	1.8
122	High	932	2.8	1.2	0.8	8.5	0.0	85.1	1.7	12.3	39.8	1.3
575	High	1064	0.4	18.3	5.2	22.7	0.0	49.0	4.4	16.9	57.8	13.2
382	High	1058	0.0	0.8	0.9	4.3	0.0	92.6	1.4	9.5	9.4	0.5

School	School Type	Student Count	% American Indian or Alaskan Native	% Asian	% Black or African American	% Hispanic/ Latino	% Native Hawaiian/ Other Pacific Islander	% White	% Two or More Races	% SWD	% Economically Disadvantaged	% English Learner
323	High	486	1.0	0.4	1.0	4.7	0.2	90.5	2.1	23	63.6	0.8
664	High	887	0.9	5.7	2.4	12.2	0.2	75.8	2.8	9.7	20.6	2.8
452	High	1564	0.3	10.7	1.3	9.7	0.1	73.7	4.2	7.0	14.1	2.9
760	High	1191	0.2	2.8	15.5	5.9	0.0	68.9	6.7	9.8	19.6	0.4
789	High	459	0.7	0.7	1.7	5.0	0.0	90.4	1.5	13.1	20.0	0.9
998	High	977	0.4	2.3	1.7	3.5	0.1	89.4	2.7	9.8	14.9	0.3
812	High	977	0.4	2.3	1.7	3.5	0.1	89.4	2.7	9.8	17.9	0.3
707	High	488	0.2	0.2	0.6	2.9	0.0	94.3	1.8	12.1	23.2	0.6
881	High	1327	0.2	5.0	3.3	5.4	0.1	81.4	4.6	10.6	16.1	0.7
120	High	1783	0.2	1.8	25.1	24.7	0.0	45.1	3.1	15.0	53.5	7.4
740	High	2228	0.3	9.1	11.7	17.9	0.0	53.8	7.2	13.8	32.1	11.9
378	High	594	0.3	2.9	1.5	26.9	0.3	66.7	1.3	16.7	37.4	8.2
931	High	1598	0.3	3.6	7.1	20.3	0.0	62.5	6.3	6.6	27.1	9.8
685	High	1563	0.2	2.8	1.7	3.3	0.0	90.7	1.3	10.6	13.8	0.6
263	High	264	1.1	0.4	1.9	4.2	0.0	90.9	1.5	12.1	38.3	0.8
934	High	1288	3.6	1.0	2.8	2.2	0.1	88.4	1.9	15.1	40.3	0.3
855	High	1288	3.6	1.0	2.8	2.2	0.1	88.4	1.9	15.1	40.3	0.3
993	High	1352	1.0	6.4	7.5	52.7	0.0	30.9	1.4	12.8	60.6	3.8
367	High	843	0.4	1.1	0.5	10.2	0.1	85.5	2.3	12.7	27.4	4.3
113	High	1546	0.4	9.4	57.9	13.6	0.1	16.0	2.6	12.5	50.2	1.4
457	High	1087	0.6	4.8	20.1	7.6	0.3	59.4	7.2	10.9	18.2	2.5
448	High	968	0.1	0.9	0.4	5.1	0.0	90.5	3.0	11.6	11.2	0.4
780	High	416	0.2	1.9	3.8	2.2	0.0	87.7	4.1	11.3	29.3	0.2
616	High	278	0.0	0.4	0.0	6.8	0.0	87.1	5.8	10.1	14.7	2.2
686	High	596	0.3	0.5	1.2	4.4	0.2	91.6	1.8	6.7	20.0	0.5
937	High	454	0.2	0.7	0.4	9.3	0.4	85.9	3.1	12.3	28.6	3.7
462	High	381	1.8	1.6	0.5	3.9	0.3	89.5	2.4	12.3	37.0	0.3
954	High	103	1.0	0.0	0.0	0.0	0.0	99.0	0.0	19.4	54.4	0.0
345	Middle	394	0.8	20.3	8.1	14.0	0.5	53.8	2.5	21.1	54.6	13.5
742	Middle	267	0.0	11.4	12.5	18.9	0.0	48.9	8.3	14.0	30.7	9.1
525	Middle	339	0.0	0.6	0.9	2.9	0.3	94.1	1.2	11.2	37.8	0.6
746	Middle	159	0.0	1.9	84.3	5.0	0.0	2.5	6.3	9.4	93.7	0.6
845	Middle	100	0.0	0.0	0.0	3.0	0.0	96.0	1.0	13.0	33.0	0.0
158	Middle	881	0.0	1.2	5.1	10.9	0.0	76.6	5.6	10.9	48.1	4.0

School	School Type	Student Count	% American Indian or Alaskan Native	% Asian	% Black or African American	% Hispanic/ Latino	% Native Hawaiian/ Other Pacific Islander	% White	% Two or More Races	% SWD	% Economically Disadvantaged	% English Learner
764	Middle	969	1.8	0.6	3.7	2.2	0.1	87.5	4.1	19.3	48.6	0.2
861	Middle	116	0.0	0.9	1.7	2.6	0.1	85.6	3.2	13.3	24.9	4.0
914	Middle	71	0.0	0.0	0.0	9.9	0.0	88.7	1.4	14.1	46.5	7.0
962	Middle	406	12.8	0.2	0.5	3.9	0.0	77.8	4.7	10.8	37.2	0.7
765	Middle	304	0.7	9.2	12.5	8.9	0.0	65.8	3.0	11.5	18.1	3.3
142	Middle	957	0.1	1.8	2.4	8.9	0.0	83.3	3.6	12.7	28.7	1.9
318	Middle	825	0.5	6.3	3.2	7.2	0.2	78.4	4.2	12.2	32.0	2.3
907	Middle	746	0.3	13.3	5.1	8.3	0.1	65.7	7.2	11.8	18.8	10.1
723	Middle	776	0.0	0.5	2.3	4.4	0.1	89.3	3.4	12.1	23.2	1.4
336	Middle	587	0.0	6.5	21.3	18.1	0.0	46.5	7.7	15.8	48.6	15.3
491	Middle	450	1.1	0.2	1.3	9.8	0.0	85.3	2.2	22.9	67.1	2.2
656	Middle	450	0.7	3.8	22.0	18.2	0.0	75.6	9.8	17.1	50.2	11.3
414	Middle	796	0.3	14.1	3.0	6.7	0.0	72.0	4.0	9.7	7.7	1.9
902	Middle	839	0.4	0.7	1.1	5.5	0.0	88.6	3.8	11.4	13.9	0.8
396	Middle	656	0.0	1.2	1.2	4.6	0.0	98.8	3.2	9.6	5.0	1.1
156	Middle	1086	0.6	1.0	1.9	1.8	0.0	91.0	3.6	14.9	35.5	0.4
428	Middle	548	0.2	16.8	7.1	22.6	0.0	46.2	7.1	16.8	65.5	15.9
778	Middle	589	0.8	15.6	5.3	16.5	0.0	58.1	3.7	18.2	51.8	10.7
888	Middle	450	1.1	0.2	1.3	9.8	0.0	85.3	2.2	22.9	67.1	2.2
157	Middle	239	0.0	1.3	0.4	8.4	0.0	87.4	2.5	8.4	18.8	3.3
611	Middle	478	0.2	7.1	20.7	19.5	0.2	39.5	12.8	13.8	59.0	17.2
701	Middle	149	0.0	0.7	4.6	11.9	0.0	83.9	6.0	10.7	20.8	2.7
926	Middle	317	1.6	0.6	0.3	3.5	0.0	90.9	3.2	12.6	17.0	1.9
530	Middle	905	0.3	8.1	0.7	2.0	0.1	85.6	3.2	13.3	24.9	4.0
478	Middle	969	1.8	0.6	3.7	2.2	0.1	87.5	4.1	19.3	48.6	0.2
427	Middle	640	0.5	4.8	1.9	14.8	0.3	75.0	2.7	10.2	26.4	5.0
183	Middle	322	0.9	5.9	6.2	8.4	0.0	73.0	5.6	15.2	48.4	9.3
676	Middle	563	0.0	3.6	8.7	20.1	0.0	61.1	6.6	8.0	30.0	15.1
438	Middle	557	0.2	14.5	12.6	9.3	0.2	55.1	8.1	8.3	27.3	6.5
506	Middle	490	0.4	6.3	1.8	4.1	0.0	84.5	2.9	10.0	15.7	2.2
591	Middle	520	0.6	2.3	3.5	11.2	0.0	78.1	4.4	14.2	32.5	3.7
135	Middle	609	0.8	0.2	3.3	3.8	0.2	90.0	1.8	18.6	52.4	0.7
619	Middle	599	0.5	0.5	1.8	8.5	0.2	85.8	2.7	15.9	45.2	3.2
486	Middle	253	1.2	0.0	2.4	7.1	0.0	82.2	7.1	11.1	44.3	2.0

School	School Type	Student Count	% American Indian or Alaskan Native	% Asian	% Black or African American	% Hispanic/ Latino	% Native Hawaiian/ Other Pacific Islander	% White	% Two or More Races	% SWD	% Economically Disadvantaged	% English Learner
334	Middle	630	0.0	0.6	0.8	11.6	0.2	84.0	2.2	11.6	30.5	4.9
863	Middle	875	0.5	7.1	10.1	6.1	0.0	70.5	5.8	12.8	20.7	0.8
385	Middle	166	2.4	1.2	0.6	2.4	0.0	89.8	3.6	21.1	51.2	0.6
136	Middle	835	0.4	22.3	2.6	5.9	0.0	63.5	5.4	11.7	10.5	3.7
904	Middle	1033	1.1	9.9	2.5	6.1	0.2	74.5	5.7	15.2	42.3	3.7
736	Middle	240	0.8	0.4	2.5	2.5	0.0	91.7	2.1	9.2	20.4	0.0
747	Middle	788	0.3	3.2	1.5	3.7	0.3	89.2	1.9	11.6	12.3	1.1
671	Middle	702	0.4	10.1	2.6	8.8	0.1	74.5	3.4	8.3	11.5	2.7
880	Elementary	319	0.3	4.4	86.2	5.6	0.0	1.3	2.2	19.1	89.0	0.6
608	Elementary	434	0.2	9.4	2.3	11.1	0.0	70.5	6.5	13.4	44.7	7.4
976	Elementary	433	0.5	1.4	2.5	3.2	0.0	88.5	3.9	11.8	20.8	1.2
273	Elementary	327	0.0	0.0	0.9	2.4	0.0	93.9	2.8	20.5	64.2	0.0
459	Elementary	339	0.0	1.8	89.1	3.8	0.3	1.8	3.2	25.1	99.1	0.6
877	Elementary	308	0.3	0.6	96.4	1.3	0.3	0.3	0.6	27.6	98.4	0.0
625	Elementary	149	1.3	0.0	94.0	2.0	0.0	0.0	2.7	12.8	94.0	0.0
332	Elementary	356	0.3	0.0	93.5	3.4	0.0	0.3	2.5	19.9	98.3	0.0
240	Elementary	211	0.0	0.9	0.9	0.9	0.0	95.3	1.9	13.3	60.7	0.9
758	Elementary	519	0.0	1.0	1.9	0.0	0.4	95.6	0.2	15.0	37.2	1.3
233	Elementary	668	0.7	1.9	0.1	3.3	0.1	91.5	2.2	13.9	16.3	1.9
311	Elementary	338	0.9	1.8	21.9	46.7	0.0	19.2	9.5	16.6	81.1	36.1
660	Elementary	571	0.4	0.4	2.6	3.3	0.0	88.8	4.6	14.2	16.8	0.0
256	Elementary	347	0.3	0.3	3.5	22.2	0.0	67.4	6.3	16.7	60.5	13.0
532	Elementary	399	0.0	1.3	1.3	6.3	0.0	89.2	2.0	12.3	15.3	1.5
117	Elementary	459	0.2	21.8	1.3	5.0	0.0	68.4	3.3	18.5	38.3	7.4
415	Elementary	423	1.4	15.1	5.4	27.9	0.0	41.4	8.7	19.6	68.6	20.8
999	Elementary	454	0.0	1.5	6.2	15.6	0.0	70.3	6.4	18.1	42.1	4.8
417	Elementary	464	0.0	5.4	0.6	0.9	0.0	90.5	2.6	12.5	15.3	3.2
112	Elementary	420	0.0	4.0	5.0	2.4	0.2	85.2	3.1	12.4	37.4	3.1
947	Elementary	508	23.8	0.0	1.8	3.0	0.0	67.5	3.9	17.7	65.2	0.0
643	Elementary	427	0.0	8.4	1.9	5.4	0.0	76.1	8.2	15.7	36.8	5.4
884	Elementary	399	0.0	4.0	0.5	6.0	0.0	86.2	3.3	11.0	3.8	2.3
353	Elementary	375	1.1	0.8	1.6	2.9	0.0	86.7	6.9	15.2	45.6	0.0
768	Elementary	750	1.1	24.8	2.9	8.4	0.0	56.7	6.1	11.9	11.1	13.2
160	Elementary	262	1.5	13.7	4.2	7.3	1.1	65.6	6.5	22.1	72.1	8.4

School	School Type	Student Count	% American Indian or Alaskan Native	% Asian	% Black or African American	% Hispanic/ Latino	% Native Hawaiian/ Other Pacific Islander	% White	% Two or More Races	% SWD	% Economically Disadvantaged	% English Learner
288	Elementary	246	0.0	2.8	8.5	13.4	0.0	65.0	10.2	16.7	52.8	3.7
397	Elementary	343	1.2	0.3	1.7	2.0	0.0	91.5	3.2	11.7	48.4	0.3
404	Elementary	311	0.3	3.2	1.0	13.2	0.0	78.8	3.5	13.5	30.9	11.3
388	Elementary	430	0.7	6.7	24.9	14.9	0.0	40.5	12.3	17.2	56.5	14.0
933	Elementary	515	0.0	3.1	5.2	33.0	0.0	53.2	5.4	6.6	40.6	30.1
944	Elementary	409	0.7	8.1	54.0	11.2	0.0	16.4	9.5	15.6	62.8	1.0
364	Elementary	523	0.0	3.1	15.5	14.9	0.0	56.8	9.8	8.0	33.8	11.3
495	Elementary	396	0.5	1.5	0.5	3.0	0.0	91.4	3.0	13.6	22.5	0.3
479	Elementary	358	0.3	11.5	0.3	1.1	0.0	82.4	4.5	13.4	27.1	8.4
786	Elementary	402	0.0	13.7	4.2	16.4	0.0	58.0	7.7	17.4	60.7	13.9
856	Elementary	581	1.5	1.0	5.2	3.6	0.0	75.4	13.3	23.9	70.1	0.2
278	Elementary	416	0.5	9.4	4.3	9.9	0.2	71.6	4.1	3.6	16.8	9.6
333	Elementary	471	1.1	0.2	0.4	5.7	0.0	87.3	5.3	17.0	52.9	0.8
680	Elementary	457	1.3	1.5	2.4	1.8	0.0	83.6	9.4	15.5	45.7	0.2
535	Elementary	282	0.0	8.2	2.1	6.4	0.7	75.5	7.1	14.2	52.1	4.6
620	Elementary	307	0.0	17.9	17.9	21.2	0.3	32.9	9.8	21.5	91.2	23.1
841	Elementary	383	0.0	5.0	11.0	11.5	0.0	61.6	11.0	15.4	35.8	12.5
384	Elementary	335	0.3	9.3	3.3	10.1	0.0	69.3	7.8	13.1	43.0	9.3
304	Elementary	456	0.2	0.2	1.5	7.9	0.0	87.1	3.1	24.3	68.9	0.7
110	Elementary	484	0.4	3.5	5.8	8.1	0.0	76.2	6.0	10.3	17.4	3.9
963	Elementary	446	0.4	7.4	3.6	5.8	0.2	78.3	4.3	12.8	33.6	4.3
214	Elementary	374	0.0	16.3	5.9	20.9	0.0	46.8	10.2	16.3	62.0	21.1
982	Elementary	130	0.8	0.0	0.8	7.7	0.0	89.2	1.5	26.2	60.8	0.0
644	Elementary	591	0.2	2.4	0.7	23.2	0.0	71.7	1.9	7.8	21.2	21.2
119	Elementary	361	0.0	4.4	15.2	16.6	0.0	51.8	11.9	8.9	38.5	22.2
541	Elementary	417	0.2	12.2	2.6	5.2	0.0	71.2	8.7	15.5	57.4	5.2
276	Elementary	413	0.2	7.7	1.2	2.2	0.0	83.5	5.1	12.1	29.5	6.8

Appendix B

Participant School Staff Demographic Data: Race and Gender

School	School Type	All Staff	Male	Female	American Indian or Alaskan Native	Asian	Black or African American	Hispanic /Latino	Native Hawaiian or Other Pacific Islander	White	Two or More Races
682	High	23	14	9	0	0	0	0	0	23	0
343	High	24	13	11	0	0	2	2	0	20	0
198	High	28	12	16	0	0	9	3	0	16	0
892	High	26	10	16	0	0	0	0	0	26	0
493	High	42	15	27	0	1	0	1	0	40	0
873	High	50	15	35	0	1	0	2	0	47	0
572	High	31	13	18	0	0	0	1	0	29	1
813	High	22	5	17	0	0	0	0	0	22	0
176	High	31	15	16	0	0	0	0	0	31	0
269	High	20	2	18	0	0	0	0	0	20	0
390	High	64	31	31	1	0	0	1	0	62	0
187	High	98	42	56	1	6	6	10	0	74	1
793	High	94	48	46	0	2	1	0	0	91	0
626	High	112	46	66	0	3	3	3	0	103	0
901	High	57	24	33	0	0	0	0	0	57	0
235	High	56	27	29	0	2	9	3	0	42	0
471	High	40	17	23	0	0	0	0	0	40	0
464	High	39	19	20	1	0	0	0	0	38	0
203	High	57	27	30	0	3	5	7	0	41	1
761	High	45	23	22	0	1	11	0	0	33	1
839	High	58	29	29	0	0	7	1	0	50	0
595	High	120	50	70	0	0	0	0	0	119	1
986	High	133	61	72	0	2	1	1	0	127	1
472	High	59	20	39	0	0	0	0	0	59	0
325	High	90	39	51	0	0	0	1	0	89	0
716	High	30	10	20	0	0	0	0	0	30	0
446	High	87	37	50	0	1	0	3	0	83	0
774	High	84	34	48	0	2	1	4	0	77	0
570	High	107	43	64	1	1	1	0	1	103	0
122	High	79	38	41	0	0	0	0	0	78	1
575	High	79	39	40	0	1	0	1	0	75	2

School	School Type	All Staff	Male	Female	American Indian or Alaskan Native	Asian	Black or African American	Hispanic /Latino	Native Hawaiian or Other Pacific Islander	White	Two or More Races
382	High	70	31	39	0	0	0	0	0	70	0
323	High	43	20	23	0	0	0	0	0	43	0
664	High	64	21	43	0	0	0	1	0	63	0
452	High	72	41	31	1	0	0	0	0	69	2
760	High	85	31	54	1	1	1	1	0	81	0
789	High	34	18	16	0	0	0	0	0	34	0
998	High	68	28	40	0	0	0	0	0	68	0
812	High	64	27	37	0	0	0	0	0	64	0
707	High	47	21	26	0	0	0	1	0	46	0
881	High	94	42	52	0	0	0	1	0	93	0
120	High	145	55	90	0	1	8	15	0	117	4
740	High	143	57	86	0	4	1	10	0	128	0
378	High	41	16	25	0	0	0	0	0	41	0
931	High	106	41	65	0	1	0	4	0	100	1
685	High	104	43	59	0	0	0	0	0	103	1
263	High	26	13	13	0	0	0	0	0	26	0
934	High	90	38	52	0	0	0	2	0	88	0
855	High	90	52	38	0	0	0	2	0	88	0
993	High	63	39	24	0	1	3	6	0	51	1
367	High	62	25	37	0	0	0	0	0	62	0
113	High	82	46	36	0	0	5	6	0	70	1
457	High	82	31	51	0	0	1	0	0	81	0
448	High	63	29	34	0	1	0	1	0	61	0
780	High	29	16	13	0	0	0	0	0	29	0
616	High	27	11	16	0	0	0	0	0	27	0
686	High	43	13	33	0	0	0	0	0	43	0
937	High	41	12	29	0	0	0	1	0	40	0
462	High	33	21	12	0	0	0	0	0	33	0
954	High	28	10	18	0	0	0	0	0	28	0
345	Middle	38	11	27	0	2	0	0	0	36	0
742	Middle	30	9	21	0	1	2	0	0	27	0
525	Middle	31	18	13	0	0	0	0	0	31	0
746	Middle	7	4	3	0	0	3	0	0	3	1
845	Middle	50	12	38	0	1	0	2	0	47	0

School	School Type	All Staff	Male	Female	American Indian or Alaskan Native	Asian	Black or African American	Hispanic /Latino	Native Hawaiian or Other Pacific Islander	White	Two or More Races
158	Middle	67	18	49	0	2	1	0	0	64	0
764	Middle	58	18	40	0	0	0	2	0	56	0
861	Middle	16	5	11	0	0	0	0	0	16	0
914	Middle	19	7	12	0	0	0	0	0	19	0
962	Middle	31	10	21	0	0	0	0	0	31	0
765	Middle	32	9	23	0	0	1	0	0	30	1
142	Middle	34	8	26	0	0	0	0	0	33	1
318	Middle	63	22	41	0	1	0	0	0	62	0
907	Middle	59	16	43	2	1	1	1	0	46	0
723	Middle	49	20	29	0	0	0	0	0	49	0
336	Middle	48	11	37	0	0	1	4	0	43	0
491	Middle	44	14	30	0	0	0	0	0	44	0
656	Middle	43	11	32	0	0	0	1	0	42	0
414	Middle	61	19	42	1	1	0	1	0	58	0
902	Middle	54	16	38	0	0	0	1	0	53	0
396	Middle	52	15	37	0	0	0	0	0	52	0
156	Middle	50	15	35	0	1	0	2	0	47	0
428	Middle	50	14	36	0	0	0	1	0	48	1
778	Middle	48	12	36	0	0	0	1	0	47	0
888	Middle	44	15	29	0	0	0	0	0	44	0
157	Middle	22	9	13	0	0	0	2	0	20	0
611	Middle	43	15	28	0	3	0	1	0	39	0
701	Middle	20	7	13	0	0	0	0	0	20	0
926	Middle	32	11	20	0	0	0	0	0	32	0
530	Middle	76	24	52	0	1	1	3	0	71	0
478	Middle	75	25	50	0	1	0	0	0	74	0
427	Middle	45	14	31	0	0	0	0	0	45	0
183	Middle	30	12	18	0	0	0	0	1	29	0
676	Middle	44	8	36	0	1	0	1	0	42	0
438	Middle	44	12	32	0	1	0	0	0	43	0
506	Middle	43	12	31	0	0	0	0	0	42	1
591	Middle	40	10	30	0	1	0	0	0	39	0
135	Middle	40	11	29	0	0	1	1	0	38	0
619	Middle	38	14	24	0	0	0	1	0	37	0

School	School Type	All Staff	Male	Female	American Indian or Alaskan Native	Asian	Black or African American	Hispanic /Latino	Native Hawaiian or Other Pacific Islander	White	Two or More Races
486	Middle	25	5	20	0	0	0	1	0	24	0
334	Middle	50	18	32	0	0	0	0	0	50	0
863	Middle	68	17	51	0	0	0	1	0	66	1
385	Middle	22	10	12	0	0	0	0	0	22	10
136	Middle	62	16	46	0	1	1	2	0	58	0
904	Middle	81	27	54	0	2	0	0	0	79	0
736	Middle	27	8	19	0	0	0	0	0	27	0
747	Middle	56	17	39	0	0	0	0	0	56	0
671	Middle	38	4	33	0	0	0	0	0	37	0
880	Elementary	17	4	13	0	0	8	0	0	9	0
608	Elementary	33	4	29	0	0	0	0	0	32	1
976	Elementary	32	2	30	0	0	0	0	0	32	0
273	Elementary	35	5	30	0	0	0	1	0	34	0
459	Elementary	24	2	22	1	1	10	1	0	10	1
877	Elementary	24	6	18	1	2	4	1	0	16	0
625	Elementary	9	0	9	0	0	3	0	0	5	1
332	Elementary	24	5	19	0	0	7	0	0	17	0
240	Elementary	28	7	21	1	0	0	0	0	27	0
758	Elementary	40	7	33	0	0	0	0	0	40	0
233	Elementary	47	7	40	0	0	0	0	1	45	1
311	Elementary	36	7	29	0	0	4	7	0	25	0
660	Elementary	43	1	42	1	1	0	0	0	39	1
256	Elementary	28	5	23	0	0	0	0	0	28	0
532	Elementary	27	1	26	0	0	0	0	0	27	0
117	Elementary	42	5	37	1	0	0	0	0	41	0
415	Elementary	39	7	32	0	0	0	0	0	39	0
999	Elementary	36	2	34	0	0	0	0	0	35	1
417	Elementary	35	5	30	0	0	0	0	0	35	0
112	Elementary	32	6	26	0	1	0	0	0	31	0
947	Elementary	64	7	57	1	0	0	0	0	56	0
643	Elementary	30	7	23	0	0	1	0	0	29	0
884	Elementary	29	3	26	0	0	0	0	0	29	0
353	Elementary	27	6	21	0	0	0	0	0	27	0
768	Elementary	53	7	46	0	1	0	1	0	51	0

School	School Type	All Staff	Male	Female	American Indian or Alaskan Native	Asian	Black or African American	Hispanic /Latino	Native Hawaiian or Other Pacific Islander	White	Two or More Races
160	Elementary	26	6	20	0	0	0	0	0	26	0
288	Elementary	25	6	19	0	0	0	0	0	25	0
397	Elementary	25	3	22	0	0	0	0	0	25	0
404	Elementary	24	4	20	0	0	0	0	0	24	0
388	Elementary	46	7	39	0	1	0	1	0	44	0
933	Elementary	45	10	35	0	1	2	10	0	32	0
944	Elementary	22	0	22	0	0	1	0	0	21	0
364	Elementary	41	5	36	0	0	0	0	0	40	1
495	Elementary	38	1	37	0	0	0	0	0	38	0
479	Elementary	35	3	32	0	0	0	0	0	35	0
786	Elementary	34	2	32	0	1	0	0	0	33	0
856	Elementary	45	8	37	0	0	0	0	0	45	0
278	Elementary	29	4	25	0	0	0	1	0	27	1
333	Elementary	43	4	39	0	0	0	0	0	43	0
680	Elementary	27	1	26	0	0	0	0	0	27	0
535	Elementary	25	2	23	0	2	0	0	0	23	0
620	Elementary	35	4	31	0	1	0	1	0	33	0
841	Elementary	35	7	28	1	2	0	0	0	32	0
384	Elementary	21	4	17	0	0	0	0	0	21	0
304	Elementary	39	3	36	0	0	0	0	0	39	0
110	Elementary	38	5	33	0	1	0	1	0	36	0
963	Elementary	27	5	22	0	0	0	0	0	27	0
214	Elementary	36	5	31	0	0	0	0	0	36	0
982	Elementary	16	1	15	0	0	0	0	0	16	0
644	Elementary	49	7	42	0	0	0	2	0	47	0
119	Elementary	32	1	31	1	0	0	0	0	31	0
541	Elementary	37	2	35	1	1	0	0	0	35	0
276	Elementary	36	4	32	0	0	0	0	0	36	0

Appendix C

Participant School Staff Demographic Data: Education Level and Teaching Experience

School	School Type	All Staff	Educational Level: Bachelor's	Educational Level: Master's	Educational Level: 6-Year Specialist/ Doctorate	Educational Level: Other	Teaching Experience: 0-5 Years	Teaching Experience: 6-10 Years	Teaching Experience: 11 + Years
682	High	23	18	5	0	0	3	5	15
343	High	24	16	5	0	3	5	1	18
198	High	28	20	4	0	4	5	7	16
892	High	26	20	6	0	0	7	3	16
493	High	42	14	28	0	0	8	9	25
873	High	50	27	23	0	0	11	8	31
572	High	31	22	9	0	0	13	8	10
813	High	22	13	9	0	0	2	6	14
176	High	31	20	11	0	0	9	4	18
269	High	20	14	6	0	0	8	3	9
390	High	64	39	25	0	0	21	12	31
187	High	98	62	23	0	13	22	17	59
793	High	94	42	52	0	0	19	12	63
626	High	112	35	68	9	0	31	20	61
901	High	57	23	33	1	0	14	8	35
235	High	56	36	7	0	13	23	10	13
471	High	40	33	7	0	0	15	7	18
464	High	39	24	15	0	0	8	12	19
203	High	57	40	7	1	9	16	12	29
761	High	45	34	4	0	7	17	8	20
839	High	58	37	12	1	8	17	11	30
595	High	120	51	69	0	0	33	17	70
986	High	133	59	74	0	0	29	13	89
472	High	59	27	30	1	1	14	10	35
325	High	90	24	66	0	0	18	12	60
716	High	30	11	19	0	0	3	5	22
446	High	87	32	53	2	0	16	18	53
774	High	84	24	58	0	2	12	17	55
570	High	107	49	58	0	0	14	16	77
122	High	79	28	50	1	0	16	14	49
575	High	79	24	54	0	1	21	6	52

School	School Type	All Staff	Educational Level: Bachelor's	Educational Level: Master's	Educational Level: 6-Year Specialist/ Doctorate	Educational Level: Other	Teaching Experience: 0-5 Years	Teaching Experience: 6-10 Years	Teaching Experience: 11 + Years
382	High	70	24	46	0	0	12	8	50
323	High	43	32	11	0	0	13	8	22
664	High	64	25	38	1	0	7	16	41
452	High	72	35	37	0	0	16	18	38
760	High	85	38	47	0	0	23	18	44
789	High	34	22	12	0	0	12	6	16
998	High	68	36	32	0	0	14	19	35
812	High	64	35	29	0	0	14	18	32
707	High	47	24	15	1	7	13	9	25
881	High	94	37	57	0	0	35	19	40
120	High	145	63	81	1	0	30	22	93
740	High	143	52	74	17	0	29	32	82
378	High	41	21	20	0	0	13	1	27
931	High	106	44	62	0	0	27	13	66
685	High	104	50	54	0	0	17	20	67
263	High	26	9	17	0	0	1	2	23
934	High	90	28	59	0	3	3	17	70
855	High	90	28	59	3	0	3	17	70
993	High	63	42	10	0	10	15	17	31
367	High	62	23	39	0	0	9	12	41
113	High	82	55	12	0	15	16	17	49
457	High	82	30	50	2	0	13	14	55
448	High	63	29	32	2	0	11	22	55
780	High	29	13	13	0	3	6	4	19
616	High	27	9	18	0	0	2	6	19
686	High	43	30	13	0	0	10	10	23
937	High	41	22	19	0	0	10	10	21
462	High	33	19	14	0	0	10	7	1
954	High	28	11	5	0	12	2	5	21
345	Middle	38	23	15	0	0	7	6	25
742	Middle	30	15	15	0	0	7	6	17
525	Middle	31	15	15	0	0	7	6	18
746	Middle	7	4	1	0	2	2	1	4
845	Middle	50	27	23	0	0	11	8	31

School	School Type	All Staff	Educational Level: Bachelor's	Educational Level: Master's	Educational Level: 6-Year Specialist/ Doctorate	Educational Level: Other	Teaching Experience: 0-5 Years	Teaching Experience: 6-10 Years	Teaching Experience: 11 + Years
158	Middle	67	31	36	0	0	18	11	38
764	Middle	58	33	24	0	0	18	11	29
861	Middle	16	14	2	0	0	7	1	8
914	Middle	19	10	9	0	0	4	4	11
962	Middle	31	6	25	0	0	2	4	25
765	Middle	32	17	15	0	0	9	7	16
142	Middle	34	13	21	0	0	4	4	26
318	Middle	63	32	31	0	0	14	16	33
907	Middle	59	21	36	1	0	7	9	43
723	Middle	49	29	19	0	0	12	14	23
336	Middle	48	24	23	0	0	16	11	21
491	Middle	44	30	14	0	0	12	9	23
656	Middle	43	20	21	1	0	12	9	22
414	Middle	61	28	33	0	0	10	8	43
902	Middle	54	15	39	0	0	5	7	42
396	Middle	52	33	19	0	0	10	7	35
156	Middle	50	27	23	0	0	11	8	31
428	Middle	50	20	29	0	1	21	3	26
778	Middle	48	29	19	0	0	8	6	34
888	Middle	44	30	14	0	0	12	9	23
157	Middle	22	16	6	0	0	6	4	12
611	Middle	43	20	19	3	0	8	10	25
701	Middle	20	8	12	0	0	3	4	13
926	Middle	32	17	15	0	0	2	5	25
530	Middle	76	27	49	0	0	18	15	43
478	Middle	75	29	46	0	0	18	13	44
427	Middle	45	21	24	0	0	6	11	28
183	Middle	30	14	16	0	0	11	3	16
676	Middle	44	25	18	0	0	11	7	26
438	Middle	44	26	18	0	0	18	9	17
506	Middle	43	16	26	0	0	14	7	22
591	Middle	40	21	19	0	0	6	4	30
135	Middle	40	15	25	0	0	10	10	20
619	Middle	38	13	25	0	0	6	5	27

School	School Type	All Staff	Educational Level: Bachelor's	Educational Level: Master's	Educational Level: 6-Year Specialist/ Doctorate	Educational Level: Other	Teaching Experience: 0-5 Years	Teaching Experience: 6-10 Years	Teaching Experience: 11 + Years
486	Middle	25	13	12	0	0	5	4	16
334	Middle	50	23	27	0	0	4	8	38
863	Middle	68	20	48	0	0	8	6	54
385	Middle	22	12	0	0	0	6	3	13
136	Middle	62	17	44	0	0	8	4	57
904	Middle	81	40	41	0	0	14	15	52
736	Middle	27	11	16	0	0	5	6	16
747	Middle	56	23	33	0	0	9	5	42
671	Middle	38	15	22	0	0	8	8	21
880	Elementary	17	12	2	0	3	6	4	7
608	Elementary	33	20	13	0	0	6	6	21
976	Elementary	32	13	19	0	0	3	10	19
273	Elementary	35	22	13	0	0	6	3	26
459	Elementary	24	8	6	0	10	8	3	13
877	Elementary	24	0	8	0	5	7	4	11
625	Elementary	9	4	4	0	1	5	1	3
332	Elementary	24	13	4	0	7	3	8	12
240	Elementary	28	23	5	0	0	11	5	12
758	Elementary	40	34	6	0	0	9	15	16
233	Elementary	47	27	20	0	0	14	11	22
311	Elementary	36	16	20	0	0	6	7	23
660	Elementary	43	28	14	0	0	18	5	20
256	Elementary	28	15	13	0	0	6	4	18
532	Elementary	27	13	14	0	0	6	4	17
117	Elementary	42	25	17	0	0	9	12	21
415	Elementary	39	21	18	0	0	11	5	23
999	Elementary	36	11	25	0	0	3	4	29
417	Elementary	35	10	25	0	0	6	7	22
112	Elementary	32	18	14	0	0	8	9	15
947	Elementary	64	39	18	0	0	7	20	37
643	Elementary	30	16	14	0	0	4	7	19
884	Elementary	29	9	20	0	0	2	4	23
353	Elementary	27	11	16	0	0	5	10	12
768	Elementary	53	24	29	0	0	12	5	36

School	School Type	All Staff	Educational Level: Bachelor's	Educational Level: Master's	Educational Level: 6-Year Specialist/ Doctorate	Educational Level: Other	Teaching Experience: 0-5 Years	Teaching Experience: 6-10 Years	Teaching Experience: 11 + Years
160	Elementary	26	12	14	0	0	1	6	19
288	Elementary	25	22	3	0	0	11	5	9
397	Elementary	25	5	20	0	0	3	6	16
404	Elementary	24	10	14	0	0	4	6	14
388	Elementary	46	28	18	0	0	12	6	28
933	Elementary	45	27	18	0	0	12	8	25
944	Elementary	22	12	3	0	7	1	2	19
364	Elementary	41	20	21	0	0	9	8	24
495	Elementary	38	23	15	0	0	11	9	18
479	Elementary	35	19	16	0	0	7	9	19
786	Elementary	34	25	9	0	0	9	2	23
856	Elementary	45	17	28	0	0	5	11	29
278	Elementary	29	18	11	0	0	5	4	20
333	Elementary	43	26	16	1	0	16	4	23
680	Elementary	27	6	21	0	0	3	5	19
535	Elementary	25	15	10	0	0	2	5	18
620	Elementary	35	6	29	0	0	5	3	27
841	Elementary	35	19	19	0	0	12	8	15
384	Elementary	21	9	12	0	0	3	1	17
304	Elementary	39	14	22	0	3	4	5	30
110	Elementary	38	19	19	0	0	11	6	21
963	Elementary	27	13	14	0	0	7	6	14
214	Elementary	36	6	30	0	0	3	2	31
982	Elementary	16	10	6	0	0	4	3	9
644	Elementary	49	24	25	0	0	8	13	28
119	Elementary	32	20	12	0	0	8	5	19
541	Elementary	37	24	13	0	0	7	8	22
276	Elementary	36	16	20	0	0	8	5	23

Appendix D

Institutional Review Board Approval Letter

June 10, 2021

Sandra Michels
Rebecca Lunde

Re: IRB Application - IRB-FY20-21-969 THE IMPACT OF NATIONAL BOARD CERTIFICATION ON SCHOOL CAPACITY

Dear Sandra Michels and Rebecca Lunde,

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study is not considered human subjects research for the following reason:

(1) It will not involve the collection of identifiable, private information.
(2) Your project will consist of quality improvement activities, which are not "designed to develop or contribute to generalizable knowledge" according to 45 CFR 46. 102(l).
(3) Evidence-based practice projects are considered quality improvement activities, which are not “designed to develop or contribute to generalizable knowledge” according to 45 CFR 46.102(l).
(4) “Scholarly and journalistic activities (e.g., oral history, journalism, biography, literary criticism, legal research, and historical scholarship), including the collection and use of information, that focus directly on the specific individuals about whom the information is collected,” are not considered research according to 45 CFR 46.102(l)(1).

Please note that this decision only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

Also, although you are welcome to use our recruitment and consent templates, you are not

required to do so. If you choose to use our documents, please replace the word *research* with the word *project* throughout both documents.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office