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An Analysis of Varying Instructional Time and the Association With Third Grade Reading and Mathematics Proficiency on the Pennsylvania System of School Assessment

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AN ANALYSIS OF VARYING INSTRUCTIONAL TIME AND THE ASSOCIATION WITH THIRD GRADE READING AND MATHEMATICS PROFICIENCY ON THE PENNSYLVANIA SYSTEM OF SCHOOL ASSESSMENT

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Title: An Analysis of Varying Instructional Time and the Association With Third Grade Reading and Mathematics Proficiency on the Pennsylvania System of School Assessment

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State-wide assessment practices began in accordance with the No Child Left Behind Act (NCLB, 2001) as an attempt to quantify student achievement. The Pennsylvania System of School Assessment (PSSA) is a standards-based, criterion-referenced assessment utilized to monitor student achievement of academic standards as well as the efficiency of school programs in supporting student attainment of such standards (Pennsylvania Department of Education, 2014). Although the 500 Pennsylvania public school districts participate in the PSSA every spring, variance exists in the number of weeks of instruction for school districts prior to administration of PSSA assessments between academic years.

This study examined varying instructional time across four academic years and resulting school district third grade proficiency rates in reading and mathematics on PSSA assessments. 1-way analysis of variance (ANOVA) and nonparametric Kruskal-Wallis tests were utilized to examine the relationships with the outcome variables. The results indicated a significant difference between short and long instruction years on reading and mathematics proficiency rates on the third grade PSSA assessment on the 1-way ANOVA. Contrary to the hypothesis, higher proficiency rates were found for short instruction years compared to long instruction years in both reading and mathematics. These results suggest that increasing instructional time did not result in higher achievement in reading and mathematics on the third grade PSSA assessment. Additionally, the latent variables resource availability as measured by aid ratio market value/personal income,

population density, and school district proficiency status were also found to be significant predictors of reading proficiency on the third grade PSSA. The latent variables of resource availability as measured by aid ratio market value/personal income and school district proficiency status were also found to be significant predictors of math proficiency on the third grade PSSA.

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CHAPTER ONE

INTRODUCTION

Since the passage of the No Child Left Behind Act (NCLB, 2001), school districts nationally have been mandated to demonstrate adequate yearly progress (AYP) in order to show accountability for their educational practices. Performance-based assessments have become a common reality for school districts across the country because passage of NCLB mandated major reform in public education. School districts which do not meet AYP standards and growth risk financial consequences, state takeover, and/or closing of underperforming schools (Shapiro, Salari, & Petscher, 2008). In addition, some states, as well as school districts, have associated student achievement on standardized state assessments with salary increases, teacher evaluations, and grounds for teacher termination (Amrein & Berliner, 2002; Ferchalk, 2013). As a result, many school districts have aligned their curricular practices and implementation materials with the defined state standards. The legislation intensified the school district accountability for student achievement through the use of group administered performance-based assessments in reading and mathematics (NCLB, 2001).

State-wide assessment practices began in accordance with the NCLB as an attempt to quantify student achievement. School districts in the Commonwealth of Pennsylvania are no exception. The 500 Pennsylvania public school districts participate in the Pennsylvania System of School Assessments (PSSA) every spring. The PSSA assessment is designed to measure how well students have achieved in the academic areas of reading, mathematics, science, and writing by aligning its content with Pennsylvania's academic standards (Pennsylvania Department of Education, 2010). In addition, Pennsylvania public school districts determine annually whether schools and districts make AYP in their attempt to reach proficiency mandates defined by NCLB.

The PSSA assessment test is a standards-based, criterion-referenced assessment utilized to monitor a student's achievement of academic standards as well as the efficiency of school programs in supporting student attainment of such standards; the results are monitored and reported by the Pennsylvania Department of Education (PDE, 2014). PSSA assessments are currently taken by public school students across the Commonwealth in grades three through eight in reading and mathematics. PSSA assessment has been replaced by the Keystone Exams for students in grade eleven as of the 2013-2014 academic year (PDE, 2014). Scores resulting from PSSA and the Keystone exams can provide information regarding student achievement, additional educational interventions for students who may be in need, and decisions regarding school district instructional practices or procedures (PDE, 2014).

Since the passing of NCLB, there has been an increased focus on proficiency in reading and mathematics in curricular across grade levels (Painter, 2006). Retner et al. (2006) in a study conducted for the Center on Education Policy indicated that approximately 71% of school districts nationally reported that state testing requirements led to increased curricular time spent on reading and mathematics, particularly for at-risk students, leading to decreased time for other subjects. The implementation of standards-based policies and instructional practices has resulted in significant gains in mathematics and positive gains in reading achievement (Swanson, 2006). The achievement gains in mathematics were strongly related to the strength of assessment policies at the state level (Swanson, 2006).

Empirical evidence suggests that relationships exist between length of instructional time and student achievement, which has resulted in schools and educational policies attempting to maximize academic learning time (Aronson, Zimmerman, & Carlos, 1999). Effective and meaningful use of instructional time in the classroom, among other variables, has been associated with achievement gains in schools where students outperform others from similar socioeconomic backgrounds (Chenoweth, 2007). Baker, Fabrega, Galindo, and Mishook (2004) found small correlations between the amount of instructional time and student performance on international achievement assessments in math, science, and civics. The use of a standards-based curriculum along with using state assessment data as feedback has resulted in higher proficiency rates (Mitchell, 2006). When supported by research-based educational practices, the literature has supported extending learning time as an effective strategy for improving student achievement (Joyner & Molina, 2012).

PDE has outlined the testing windows for school districts in their annual PSSA handbooks. The testing window for PSSA assessments in reading and mathematics during the 2009-2010 academic year was in April 2010 (PDE, 2009). The testing window for PSSA assessments in reading and mathematics during the 2010-2011 academic year was in March 2011 (PDE, 2010). The testing window for PSSA assessments in reading and mathematics during the 2011-2012 academic year was in March 2012 (PDE, 2011). Finally, the testing window for PSSA assessments in reading and mathematics during the 2012-2013 academic year was in April 2013 (PDE, 2012). As a result, among school years, there is variance in the number of weeks of instruction for school districts prior to administration of PSSA assessments. This variance may be a factor impacting on school district performance on PSSA assessments.

This raises questions regarding the impact of other variables on school district performances on PSSA assessments such as school district setting, school district expenditures, student-teacher ratio, and proficiency status. Several studies have found that students from urban areas perform better on standardized achievement tests in comparison to students from rural areas (Borland & Howsen, 1999). Jones and Slate (2011) found correlations between the percentage of instructional expenses and student achievement on state assessments. Data from the Tennessee Project STAR found that smaller class sizes produced increased improvement in academic achievement in all academic areas (Mosteller, 1995). Carnoy and Loeb (2002) concluded that high-accountability states had greater mean improvements in mathematics when compared to states with little or no state initiatives at improving student performance on the National Association of Education Progress (NAEP) assessments.

The Problem

Lingering questions remain regarding PSSA assessment practices and guidelines provided by the commonwealth annually. Why, if school districts must demonstrate AYP and growth in the areas of reading and mathematics, does the testing window for administering PSSA assessments change from year to year? Why are PSSA assessments administered in March one year and April the following year? Is there a potential impact with limiting the weeks of instruction prior to the administration of PSSA assessments, as well as changing this comparison from year to year, on school districts? What impact do other variables, such as resource availability, interaction density, population density, and AYP status, have on school district performance on PSSA assessments?

This study plans to address the issue of the timeline in which the PSSA is administered to students in the Commonwealth of Pennsylvania and determine if this affects district proficiency rates in reading and mathematics. Specifically, does the year in which the PSSA is administered have an impact on the school district proficiency rates for third graders in the areas of reading and mathematics, where administration dates differed (March administrations compared to April administrations) resulting in varying instructional time between testing administrations? Specifically, does the corresponding weeks of instruction prior to the test administration of that school year impact reading and mathematics proficiency rates for school districts?

Research Questions

The purpose of this study is to examine varying instructional time across four academic school years and the resulting school district third grade proficiency rates in reading and mathematics on PSSA assessments. Specifically, the research study will determine the following:

(1) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area of reading in third grade?

(2) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area of mathematics in third grade?

(3) Do any associations exist among the following variables: resources availability, population density, interaction density, and school district annual yearly progress status?

Hypotheses

The first hypothesis is that there will be an association between the instructional time measured by weeks of instruction prior to PSSA assessments for corresponding academic years and district third grade proficiency rates in both reading and mathematics. It is hypothesized that stronger associations in both reading and mathematics proficiency in third grade will be found in school years where the PSSA assessment window was later in the school year (April) in comparison to gains made where the testing window was earlier (March). Therefore, it is hypothesized that stronger associations in reading and mathematics proficiency in third grade will be found in school years with a greater number of weeks of instruction, as measured by the instructional time for PSSA assessments.

The second hypothesis is that there will be correlations among the ancillary variables, including district resource availability, district population density, district interaction density, and district AYP status, and school district third grade PSSA proficiency rates in both reading and mathematics. It is hypothesized that there will be a moderate positive correlation between district resource availability and third grade proficiency rates in both reading and mathematics. It is hypothesized that there will be a small positive correlation between district population density and third grade proficiency rates in both reading and mathematics. It is hypothesized that there will be moderate positive correlation between district interaction density and third grade proficiency rates in both reading and mathematics. It is hypothesized that there will be a small positive correlation between district AYP status and third grade reading and mathematics proficiency rates.

Finally, it is hypothesized that associations will exist between the following latent variables: resources availability, population density, interaction density, and school district AYP status. See Figure 1.

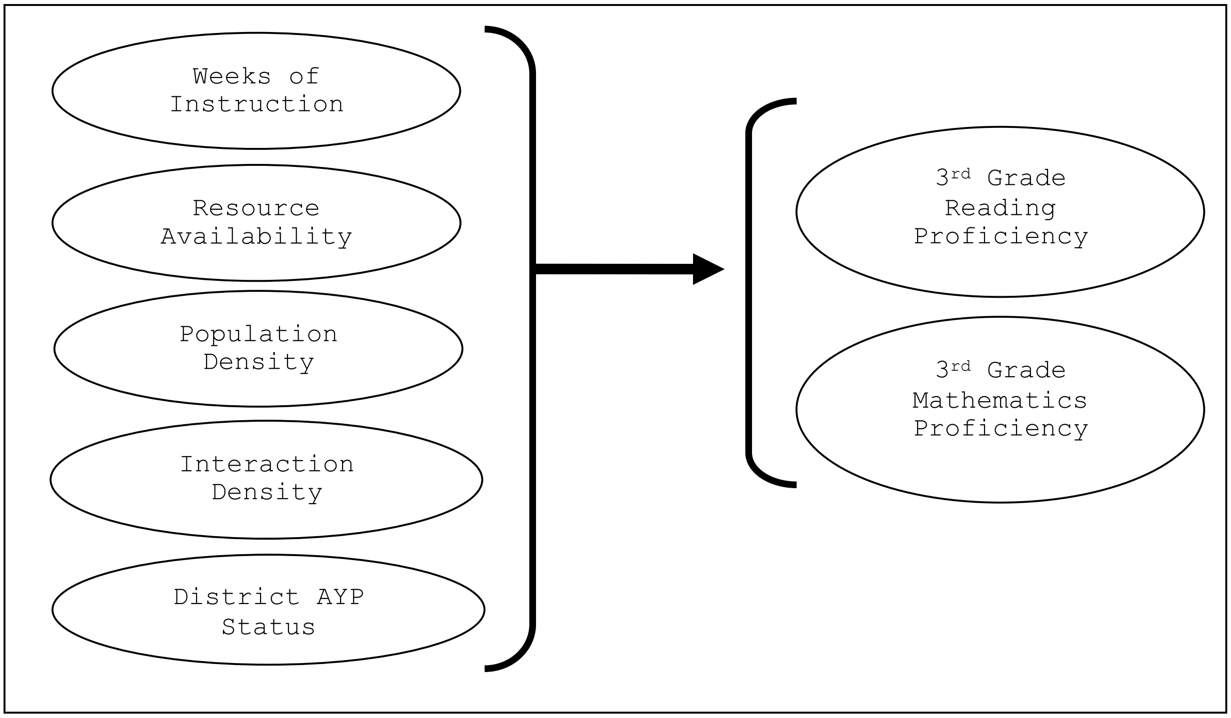

Figure 1. Research path diagram of the latent variables.

Problem Significance

School districts often search for guidance when trying to increase levels of achievement among their students measured by state assessments (Amrein & Berliner, 2002). Although each state is mandated to monitor student achievement through state assessments, the date in which the state assessments are administered can vary between academic years. In Pennsylvania, the PSSA has been given on dates in March or April for the past several years. PDE has outlined the testing windows for school districts in their PSSA handbooks distributed annually. The testing window for PSSA assessments in reading and mathematics during the 2009-2010 academic year was in April 2010. The testing window for PSSA assessments in reading and mathematics during the 2010-2011 academic year was in March 2011. The testing window for PSSA assessments in reading and mathematics during the 2011-2012 academic year was in March 2012. Finally, the testing window for PSSA assessments in reading and mathematics during the 2012-2013 academic year was in April 2013. Such variations in administration timelines may complicate school district statistics related to student achievement, particularly in academic years where the tests are administered earlier in the school year, resulting in a shorter amount of instructional time prior to assessment administration.

PDE has defined anchor content standards and eligible content for PSAA assessments aligned with the Pennsylvania curricular standards despite variation in administration timelines. The anchor content standards and eligible content were implemented beginning with the 2007 PSSA assessment (Data Recognition Corporation, 2013). These were established in response to educator concerns regarding the quantity and detail of the state academic standards in order to indicate which parts of the standards would be assessed on the PSSA assessments (DRC, 2008). Despite the testing windows varying between academic school years, the content standards and eligible content established by PDE have not changed to accommodate fluctuating weeks of instruction between school years as these are listed the same in the 2013 Technical Report. The anchor content standards on the PSSA and the corresponding distribution of content standards are listed in Table 1.

In addition to content standards and eligible content, PDE has also established scale score benchmarks to define individual student proficiency rates in the areas of reading and mathematics in the Technical Report for the PSSA (2008). These established benchmark scale scores, which were established by PDE in 2007, have been the benchmark utilized to define proficiency rates in reading and mathematics for third graders in Pennsylvania since this time. Again, despite the testing windows varying between academic school years, the quantitative definition established by PDE has not changed to accommodate fluctuating weeks of instruction between school years, where the same cut scores were defined in the 2013 Technical Report (DRC, 2013). See Table 1.

Table 1

PDE Content Standards for Third Grade PSSA

PSSA Assessment	Reporting Category	Content Percentage
Mathematics	Numbers and Operations	40-50%
	Algebraic Concepts	12-15%
	Geometry	12-15%
	Measurement	12-15%
	Data Analysis	12-15%
Reading	Comprehension and Reading Skills	60-80%
	Interpretation and Analysis of Fictional/Nonfictional Text	20-40%

Note. Adapted from *Technical Report for the 2013 Pennsylvania System of School Assessment* by Data Recognition Corporation (2013).

Table 2

PDE Scale Score Benchmarks for Third Grade PSSA

PSSA Assessment	Benchmark Scale Score	Benchmark Descriptor
Mathematics	1370	Advanced
	1180	Proficient
Reading	1442	Advanced
	1235	Proficient

Note. Adapted from *Technical Report for the Pennsylvania System of School Assessment: 2007 Reading and Mathematics Grades 3, 4, 5, 6, 7, 8, and 11* by Data Recognition Corporation (2008).

With state assessments mandated by federal guidelines and consequences in place for not meeting state standards, school districts will want to make assessment conditions as appropriate to encourage student achievement and accurate assessment. This research study provides potential implications for current high-stakes assessment practices in the Commonwealth of Pennsylvania, particularly the potential impact of varying weeks of instruction prior to PSSA administration on defined student achievement. A thorough analysis of the variables examined in this study could be utilized for recommendations that will help to improve current commonwealth practices of assessing reading and mathematics proficiency, as well as high-stakes decision making regarding AYP. This may include the establishment of a minimum number of weeks of instruction prior to the administration of PSSA assessments as well as pushing the testing window for these assessments to later into the academic year. Such practice revisions may increase instructional time for teachers in presenting academic material throughout the course of the academic year as opposed to a “mad rush” before the testing window assigned to the academic year. Therefore, this study may provide useful information to educators and state officials so that PSSA assessments are given at an appropriate time to accurately measure acquisition and retention of state curriculum standards. Additionally, this study may also provide useful information in helping school districts and educators obtain a revised commonwealth assessment timeline in order for curriculum standards to be taught at an appropriate pace.

Definitions

Adequate Yearly Progress (AYP)

As reported by PDE, the federal No Child Left Behind Act required states to determine annually whether schools and districts in Pennsylvania make Adequate Yearly Progress, also known as AYP.

Advanced

An individual student’s scale score of 1442 or above on the third grade reading PSSA assessment and/or an individual student’s scale score of 1370 on the third grade mathematics PSSA assessment (DRC, 2013).

Instructional Time

For the purpose of this study, defined as the weeks of instruction between the first student day and the beginning of the testing window for PSSA assessments for the academic year. This term is broader than allocated time or academic engaged time, which are defined as time in which students are effectively engaged in academic instruction.

Interaction Density

Defined as the number of students per teacher per school district in the state of Pennsylvania.

Pennsylvania Department of Education (PDE)

The governing agency that oversees the operation of public education in the state of Pennsylvania. The mission of PDE is, "to assist the General Assembly, the Governor, the Secretary of Education, and Pennsylvania educators in providing for the maintenance and support of a thorough and efficient system of education," (PDE, 2010).

Pennsylvania System of School Assessment (PSSA)

A standardized measure of reading and mathematics achievement given to children in third grade through eighth grade enrolled in public school districts in the Commonwealth of Pennsylvania.

Population Density

Defined as the number of students per square mile per school district in the state of Pennsylvania. The Commonwealth of Pennsylvania has utilized the Urban-Centric Locale System to classify school districts into one of twelve categories based upon population density.

Urban-Centric Locale System. The classification of all the school districts in Pennsylvania into one of twelve locale codes. The urban-centric locale codes are defined as follows: City-Large, City-Midsize, City-Small, Suburban-Large, Suburban-Midsize, Suburban-Small, Town-Fringe, Town-Distant, Town-Remote, Rural-Fringe, Rural-Distant, and Rural-Remote (PDE, 2014).

Proficiency

The rate in which school districts perform in the range of Proficient or Advanced on PSSA assessments in reading and in mathematics. School district proficiency is calculated by the percentage of students scoring in the Proficient or Advanced range on the PSSA; the greater number of students performing in the Proficient or Advanced range, the higher the school district proficiency rate (PDE, 2014).

Proficient

An individual student's scale score of 1235 or above on the third grade reading PSSA assessment and/or an individual student's scale score of 1180 on the third grade mathematics PSSA assessment (DRC, 2013).

Resource Availability

Defined as the economic contributing factors of the student as reported by the annual school district cost per student or the state aid ratio.

Aid Ratio. Defined as a school district's combined market value (MV) and personal income (PI) wealth for each resident student compared to the state average in order to demonstrate the financial wealth of a school district. The lower the MV/PI Aid Ratio, the less dependent the school district is on state funding (PDE, 2012).

School Status.

Defined as the status in which a school district falls in regards to achieving AYP (i.e. did the school district achieve AYP the previous academic school year).

Assumptions

It is an assumption that the PSSA assessments were administered with integrity and fidelity across school districts, where third grade students participated in completion of the tests in both reading and mathematics. As it is mandated that all public school district students participate in state assessments, it is assumed that all eligible third graders participated in the assessment during the corresponding academic year. It is also assumed that standardization was adhered to in all school districts in the state of Pennsylvania during the administration.

Additionally, it is assumed that students who participated in PSSA assessments in reading and mathematics received comparable instruction on third grade curricular standards prior to the administration of the tests. School districts are required to align curricular practices with the established state standards to the corresponding academic years (PDE, 2014). Likewise, it is also assumed that students received instruction in reading and mathematics in third grade from a qualified and certified elementary teacher. NCLB (2001) mandated that teachers providing direct instruction in one or more of NCLB core content areas were to demonstrate "highly qualified teacher" status. Pennsylvania defines a highly qualified teacher as one who holds at least a bachelor's degree, holds a valid Pennsylvania teaching certificate, and demonstrates subject matter competency in the core content area they teach (PDE, 2015). The qualifications of a highly qualified Pennsylvania teacher status is assumed as part of the core instruction in reading and mathematics for third graders who participated in PSSA assessments in the academic years to be examined.

Limitations

A limitation of this study is that other factors that are not being examined may influence school districts' proficiency in reading and mathematics in third grade populations. School district curricular materials for teaching reading and mathematics standards in third grade may differ, as there are no statewide curricular publications. Because each school district is able to choose its own curricular materials, this may have impacted reading and mathematics proficiency rates. Moreover, multiple teachers across school districts have taught state curriculum standards in reading and mathematics between the 2009-2010 academic year and the 2012-2013 academic years. Teacher attrition rates amongst third grade teachers in Pennsylvania school districts may have also had an indirect impact on proficiency rates across these academic years.

Another limitation of this study is the weeks of instruction between school districts could vary between the start of the instructional year and the beginning of the testing window set forth by PDE. Pennsylvania requires school districts to provide 180 days of instruction, including 900 hours of instruction for elementary students (Romeo, 2014; PDE, 1997). However, this regulation does not issue a mandatory start date for the beginning of the school year. Rather, this regulates the amount of instructional time school districts are required to provide each academic year. Therefore, the weeks of instruction prior to the PSSA testing windows provided by PDE may vary between school districts depending on the date in which the school district calendar verified as the student start date of that particular school year. However, this limitation may provide further support to the problem significance of this study seeking to increase instructional time prior to administration of state assessments.

A final limitation of this study is that it only examines school district proficiency of third grade students across Pennsylvania. Though this grade level was chosen as a baseline of assessment, this may limit the generalizability within other grade levels across the state. As such, the patterns between academic years for third grade reading and mathematics proficiency amongst academic years may differ if other grade levels were to be later examined.

CHAPTER TWO

LITERATURE REVIEW

This review of literature focuses on the purpose of this study, which is to determine the relationship between varying weeks of instruction time and resulting academic achievement. This chapter will explore previous research related to instructional time and consequent academic achievement. Initiatives and instructional trends related to the No Child Left Behind Act (NCLB, 2001) will also be explored, because this legislation intensified the accountability of school districts to increase student achievement through the use of group administered performance-based assessments. In the Commonwealth of Pennsylvania, these assessments have historically varied in the testing window outlined by the state between academic years as defined by the Pennsylvania System of School Assessment (PSSA) annual handbooks. Therefore, it is important to explore historical trends within the literature regarding instructional time and its relevance to demonstrated academic achievement. The literature on the opportunity to learn in schools often explores the amount of time dedicated to instruction, where instructional time is frequently a common point of comparison of cross-national research (Baker, Fabrega, Galindo, & Mishook, 2004). These trends include research evidence both in support and against increased instructional time as a resource for increasing academic achievement. Additional variables, including resource availability, interaction density, population density, and proficiency status, and their impact on demonstrated academic achievement will also be explored.

Historical Views on Instructional Time

A belief exists at the national and international level that increased instructional time increases academic achievement, where policymakers and educational reformers have mimicked this sentiment and advocated for an increase in the length of the school day and year as well to make better use of instructional time (Long, 2014). A Gallop poll by Phi Delta Kappa indicated that 96% of respondents thought increasing time spent on instruction was a somewhat or very effective strategy for lowering the gap between high and low achievers (Teixeira, 2007). Examples include the National Commission on Educational Excellence (1983), the Center for American Progress (2005), and President Barack Obama's Secretary of Education, Arne Duncan (Klein, 2009).

A report authored by the National Commission of Excellence in Education (NCEE, 1983) under the direction of then Secretary of Education Terrell Bell entitled *A Nation at Risk* was released to the public with a press conference led by President Ronald Reagan (Graham, 2013). This historical initiative outlined recommendations regarding areas of educational reform at the national level and included an increase in instructional time for American students (Long, 2014). The report compared American student achievement data with other nations. The report concluded that major educational reforms for curriculum, student achievement expectations, assessment, and instructional time were necessary; specifically, longer instructional time through an increase to the school day and school year was recommended (Houchens, 2008; NCEE, 1983). Since the report was released 30 years ago, all states have adopted increased academic standards as mandated through legislation such as the passages of the Individuals with Disabilities Education Improvement Act (2004) as well the reform of the Elementary and Secondary Education Act (ESEA) of 1965 through the passage of the No Child Left Behind Act in 2001; forty-five states have also adopted the Common Core State Standards in an attempt to provide necessary knowledge and skills for success outside the classroom (CAP, 2005). Such factors have been argued as contributing to student achievement gains, particularly in mathematics, over the past decade (Swanson, 2006).

The National Education Commission on Time and Learning (1994) advocated for the revision of school calendars. The report estimated that French, German, and Japanese students received more than twice the amount of instruction than American students suggesting Americans could receive a high school diploma if they devoted only 41% of their time in school to academic work; further, the commission considered instructional time as an important variable to the learning process and suggested that American students were "prisoners of time" (Baker et al., 2004). Priority changes included the historical involvement of students within the agricultural industry. The nine month school calendar emerged when approximately 85% of Americans were dependent on agriculture; this number had waned down to approximately 3% by the 1990's (Cooper, Nye, Charlton, Lindsay, & Greathouse, 1996).

As a result, suggestions have emerged on how to best revise school calendars to include more time for instruction such as extending the school year to increase the numbers of days in school as well as schedule changes that use the school buildings year-round are both examples (Cooper et al., 1996). Proponents of these changes argued that such reforms would increase the amount that students were learning while more closely fitting the lifestyle of American families (Gandara & Fish, 1994). Skeptics of these reforms questioned economic factors, fatigue of students and teachers, and whether an increase in the quantity of instructional time translated into student achievement (Cooper et al., 1996; Karweit, 1985; Mazzerella, 1984; Merino, 1983;). Nonetheless, increasing learning time for low-performing students has become a notable talking point in policy discussions (Farbman, Christie, Davis, Griffith, & Zinth, 2011).

Impact of NCLB on Instructional Time

The No Child Left Behind Act (NCLB, 2001) mandated school districts to demonstrate adequate yearly progress (AYP) in order to demonstrate accountability of educational practices. This legislation required group administered performance-based assessments at the state-level to be conducted on a yearly basis in order for school districts to demonstrate the effectiveness of instructional practices. School districts that did not demonstrate AYP standards and achievement growth faced potential financial penalties in the form of reduced funding, district takeover by state education consultants, or, in some extreme cases, the closing of schools that did not demonstrate expected growth (Shapiro, Salari, & Petscher, 2008). Some states, as well as school districts, have increased incentives for increased student achievement with potential salary increases and teacher evaluations as a result of these mandates; lack of achievement has also been argued to be grounds for termination of employment for teachers (Amrein & Berliner, 2002; Ferchalk, 2013). Therefore, this legislation intensified the accountability of school districts to increase student achievement (NCLB, 2001). The amount of time dedicated to instruction is frequently examined as a central resource in the educational process (Baker et al., 2004). Data from the National Assessment of Educational Progress (NAEP) has found that average weekly instructional time is greater in reading than in mathematics and instructional time in both subjects declines from grade 4 to grade 8 (Ginsburg & Chudowsky, 2012).

Empirical evidence also suggests that relationships exist between instructional time and student achievement. This belief has resulted in schools and educational policies attempting to maximize academic learning time (Aronson, Zimmerman, & Carlos, 1999). Effective and meaningful use of instructional time in the classroom, among other variables, has been associated with achievement gains in schools where students outperform others from similar socioeconomic backgrounds (Chenoweth, 2007). Baker et al. (2004) found small correlations between the amount of instructional time and student performance on international achievement assessments in mathematics, science, and civics. The use of a standards-based curriculum along with using state assessment data as feedback has resulted in higher proficiency rates (Mitchell, 2006). When supported by research-based educational practices, the literature has supported extending learning time as an effective strategy for improving student achievement (Joyner & Molina, 2012). Such logic can be generalized for maximizing instructional time prior to assessing student achievement on state assessments.

The majority of states in the US have instructional time requirements that are established in laws and educational regulations. Most states require a minimum of 180 instructional days a school year; however, states vary in whether or not public schools are required to have a minimum number of instructional days, instructional hours, and/or instructional hours in a school day per year (Farbman et al., 2011). The minimum instructional time expectations for each state were reported in *Learning Time in America: Trends to Reform the American School Calendar* by Farbman et al. (2011). See Table 3.

Table 3

State Minimum Instructional Time Expectations

US State	Minimum Instructional Days per Year	Minimum Instructional Hours per Year	Minimum Instructional Hours per Day
Alabama	180	n/a	6
Alaska	170	Elementary: 740 Secondary: 900	Elementary: 4 Secondary: 5
Arizona	180	Kindergarten: 356 Primary: 712 Intermediate: 890 Secondary: 1000	4
Arkansas	178	n/a	6 per day or 30 per week
California	175/180	Kindergarten: 600 Primary: 840 Intermediate: 900 Secondary: 1090	Kindergarten: 3 Primary: 3.83 Intermediate/ Secondary 4
Colorado	160	Kindergarten: 435 or 870 Elementary: 968 Secondary: 1056	n/a
Connecticut	180	Kindergarten: 450 or 900 Elementary/ Secondary 900	5
Delaware	n/a	Kindergarten: 1060	31.5 per week
District of Columbia	178	n/a	Secondary: 6
Florida	180	Primary: 720 Elementary/ Secondary: 900	5
Georgia	180	Primary: 810 Intermediate: 900 Secondary: 990	Primary: 4.5 Intermediate: 5 Secondary: 5.5
Hawaii	180	Elementary: 915 Secondary: 990	Elementary: 6 Secondary: 6.5
Idaho	n/a	Kindergarten: 450 Primary: 810 Intermediate: 900 Secondary: 990	n/a

US State	Minimum Instructional Days per Year	Minimum Instructional Hours per Year	Minimum Instructional Hours per Day
Illinois	n/a	n/a	Kindergarten/ Grade 1: 4 Elementary/ Secondary: 5
Indiana	180	n/a	Elementary: 5 Secondary: 6
Iowa	180	n/a	5.5 per day or 27.5 per week
Kansas	186	Kindergarten: 465 Elementary/ Secondary: 1116 12 Grade: 1086	n/a
Kentucky	177	1062	6
Louisiana	177	1062	6
Maine	175	n/a	n/a
Maryland	177	1080	6
Mass-achusetts	180	Kindergarten: 425 Elementary: 900 Secondary: 990	n/a
Michigan	170	1098	n/a
Minnesota	n/a	n/a	n/a
Mississippi	180	n/a	5.5 per day and 27.5 per week
Missouri	174 (5 day) 142 (4 day)	1044	3 hours per day (5 day week) 4 hours per day (4 day week)
Montana	n/a	Kindergarten: 360 or 720 Elementary: 1032 Secondary: 1090	n/a
Nebraska	n/a	Kindergarten: 400 Elementary: 1032 Secondary: 1080	n/a

US State	Minimum Instructional Days per Year	Minimum Instructional Hours per Year	Minimum Instructional Hours per Day
Nevada	180	n/a	Kindergarten: 2 Primary: 4 Intermediate: 5 Secondary: 5.5
New Hampshire	180	Elementary: 945 Secondary: 990	Kindergarten – 5 Grade: 5.25 6-8 Grade: 5.5
New Jersey	180	n/a	4
New Mexico	180	Kindergarten: 450 or 990 Elementary: 990 Secondary: 1080	Kindergarten: 2.5 or 5.5 Elementary: 5.5 Secondary: 6
New York	180	n/a	Kindergarten: 1.5 or 5.5 Elementary: 5 Secondary: 5.5
North Carolina	182	1000	5.5
North Dakota	181	Elementary: 951.5 Secondary: 1038	Elementary: 5.5 Secondary: 6
Ohio	182	910	Elementary: 5 Secondary: 5
Oklahoma	180	Elementary: 900 Secondary: 1080	6
Oregon	n/a	Kindergarten: 405 Primary: 810 Intermediate: 900 Secondary: 990	n/a
Penn-Sylvania	180	Kindergarten: 450 Elementary: 900 Secondary: 990	Kindergarten: 2.5 Elementary: 5 Secondary: 5.5
Rhode Island	180	n/a	Kindergarten: 2.75 Elementary: 5.5 Secondary: 5.5
South Carolina	180	n/a	6

US State	Minimum Instructional Days per Year	Minimum Instructional Hours per Year	Minimum Instructional Hours per Day
South Dakota	n/a	Kindergarten: 437.5 Primary: 857 Intermediate/ Secondary: 962.5	n/a
Tennessee	180	n/a	6.5
Texas	180	n/a	7
Utah	180	Kindergarten: 450 Grade 1: 810 Elementary/ Secondary: 990	n/a
Vermont	175	n/a	Kindergarten: 2 or 10 per week Grade 1-2: 4 or 20 per week Elementary/ Secondary: 5.5 or 27.5 per week
Virginia	180	Kindergarten: 540 Elementary/ Secondary: 990	5.5
Washington	180	Kindergarten: 540 Elementary: 1000 Secondary: 1090	n/a
West Virginia	180	n/a	5.5
Wisconsin	180	Kindergarten: 437 Elementary: 1050 Secondary: 1137	n/a
Wyoming	180	Hours equal to 180 days	n/a

Note. Adapted from *Learning Time in America: Trends to Reform the American School Calendar* by Farbman et al. (2011).

Policymakers have continued to include the topic of increased instructional time as part of the dialogue on educational legislation and initiatives. President Obama (2009) included the topic in his address to the Hispanic Chamber of Commerce and called for revision to the school day to include more time through summer learning or expanded-day programs. This sentiment has also been reflected by the current US Secretary of Education Arne Duncan, where he has called for the reauthorization of the ESEA to include expanded learning time in school (Klein, 2009). The American Recovery and Reinvestment Act (ARRA, 2009) proposed expanded funding opportunities for increased instructional time while the anticipated reauthorization of ESEA has included discussions amongst policymakers on increasing learning time for low-performing students (Farbman et al., 2011).

Such sentiments have also recently been reflected at the state level. Massachusetts has created the Expanded Learning Time (ELT, 2010) Initiative as the result of state policies to revise and increase the instructional day for students as a strategy to improve student achievement. The initiative has piloted 22 schools serving approximately 12,000 students where the school day was redesigned to add 300 hours of instruction per academic year. The initiative found an increase in achievement gains on state assessments in English/language arts, mathematics, and science in comparison to state averages including double the rate of improved proficiency was reported for the pilot schools in the Massachusetts initiative. As a result, then Governor of Massachusetts Deval Patrick referred to expanded learning time as a “key component” for educational reform in the state and increased funding for the ELT Initiative from $4 million to $18.2 million in his proposed 2015 fiscal year budget (Mastoras, 2014). The Massachusetts ELT Initiative has also inspired national policies on instruction time at the Congressional level, including the proposed Time for Innovation Matters in Education (TIME) Act of 2011 as well as similar wording into the future reauthorization of ESEA (Farbman et al., 2011).

Other states have followed the example of the Massachusetts ELT Initiative with state-level policies that have a focus on increasing instructional time. Farbman et al. (2011) outlined several such state initiatives from Washington, Maryland, Connecticut, and Hawaii among others in the publication *Learning time in America: Trends to reform the American school calendar.* Washington State passed House Bill 2261 in 2009 that increased the school year from an average of 1,000 hours to a minimum 1,080 instructional hours for secondary, 1,000 instructional hours for elementary, and 1,000 instructional hours for kindergarten students (Long, 2014). Maryland passed House Bill 439 in 2010 which directed the state board of education to research various scheduling models that decrease prolonged lapses in instructional time in low-performing and at-risk schools. Connecticut passed Senate Bill 929 in 2011 allowing low-performing schools to increase instructional hours as a strategy to improve student achievement. Hawaii, which had decreased the minimum days of instruction from 180 days to 163 days in 2009 as a fiscal savings measure, later passed House Bill 2486 requiring a plan to increase the number of instructional days to 190 and instructional hours to 1,140 by the 2015-2016 school year. Additional states such as Colorado, Oklahoma, and Rhode Island have developed task forces at the state-level to explore the idea of instruction time reforms and expanded learning time initiatives.

Retner et al. (2006) in a study conducted for the Center on Education Policy indicated that approximately 71% of school districts nationally reported state testing requirements led to increased curricular time spent on reading and mathematics. Key findings from this study included shifts in instructional time from other subjects towards English/language arts and mathematics since the passage of NCLB in 2002. The authors found that the increase in time spent on reading and mathematics was particularly evident for at-risk students. The authors also suggested that the increase time spent on reading and mathematics lead to decreased time for other subjects. Additionally, 43% of school districts nationwide reported increased instructional time in these subjects while cutting other subjects 75 minutes or more per week (McMurrer, 2008). The implementation of standards-based policies and instructional practices has resulted in significant gains in mathematics and reading achievement (Swanson, 2006).

Shifts on the amount of instructional time for each subject were reported in *Instructional Time in Elementary Schools: A Closer Look at Changes for Specific Subjects* by McMurrer (2008). See Table 4.

Table 4

Comparisons of Instructional Time per Week Before and After the Implementation of NCLB

Academic Subject	Average Minutes of Instruction - Pre-NCLB	Average Minutes of Instruction - Post NCLB	Average Increase/ Decrease Percentage
English/ Language Arts	378	520	+47%
Mathematics	264	352	+37%
Social Studies	239	164	-32%
Science	226	152	-33%
Art/ Music	154	100	-35%
Physical Education	115	75	-35%
Recess	184	144	-28%

Note. Adapted from *Instructional Time in Elementary Schools: A Closer Look at Changes for Specific Subjects* by McMurrer (2008).

Instructional Time and Impact on Achievement

The impact of instructional time has been a topic of research interest within the literature in order to study its efficacy as a way for schools to increase student achievement (Long, 2014). Marcotte and Hemelt (2007) analyzed the impact of school closings from inclement weather in the state of Maryland over a ten year period. The study found that student academic performance on the Maryland State Performance Assessment Program (MSPAP) exams during academic years of heavy snow fall declined in comparison to years with fewer school closings due to inclement weather. Students in the lower elementary grades were most impacted by school closings due to weather (Marcotte, 2007).

Blank (2013) explored the national trend in the decline of instructional time in the elementary grades in the area of science over the past two decades. The study found that time spent on instruction in the area of mathematics and language arts had increased to over 1 hour and 2 hours respectively while science instruction has decreased to an average of 28 minutes a day. A positive correlation was also found between the time spent on science instruction and academic achievement on the National Assessment of Educational Progress (NAEP) science examination in 4th graders. Students with the highest science instructional time per week had 12 points on average increased achievement score in comparison to students with the lowest amount of time spent on science instruction in the study.

Additional analysis of NAEP data by Ginsburg and Chudowsky (2012) found a negative correlation between student absenteeism and performance on the NAEP assessments. Students who were absent for three or more days a month were more likely to score in the Below Basic range. The authors recommended schools improve absenteeism of lower-achieving students as a strategy for increasing academic achievement due to the strong association between the two factors.

Additional evidence has been explored regarding an effect of increased instructional time on student achievement at the national level. Cooper et al. (1996) conducted a meta-analysis exploring the impact of summer vacation on student achievement by reviewing 39 studies on the topic. The authors found that summer loss equaled approximately one month of grade-level growth or one-tenth of a standard deviation on spring test scores. The impact was greatest in mathematics calculations and spelling achievement compared to reading. The authors recommended that the results of the meta-analysis be utilized as evidence supporting school calendar reform, as summer vacation appeared to have a negative impact on learning.

The impact on instructional time and subsequent academic achievement has also been used as evidence to support kindergarten programs to transition to full-day models. Rathburn (2010) found that children in kindergarten programs that allotted a large portion of the school day to reading instruction made increased gains in reading achievement compared to students who spent less time on reading instruction on the Early Childhood Longitudinal Study, Kindergarten Class of 1998-1999. The author recommended an increase in time devoted to reading instruction in kindergarten as a practice to prepare students for first grade curriculum expectations and later school success.

International Comparisons

The perceived performance gap between American students and foreign counterparts has prompted comparisons on time spent on instruction, where an assumption exists that more time in school should result in additional learning and increased student performance (Joyner & Moliner, 2011). Interest of policymakers in studies conducted by the International Association for Evaluation of Educational Achievement (IEA) has been growing in the past two decades (Drent, Meelissen, & van der Kleij, 2013). The Organization for Economic Co-Operation and Development (OECD, 2008) examined the issue of instructional time at the global level. The OECD is comprised of 30 countries that analyze international economic, environmental, and social issues that include countries from North America, Europe, and Asia. Through the analysis of data from participating countries, the OECD reported that the total number of instructional hours students received ranged from 5,644 hours in Estonia, to over 8,000 hours in Italy, the Netherlands, and Chile between the ages of 7 to 14. Despite comparing countries with different curriculum policies and priorities, the report concluded that instructional time was a necessary factor to consider in students achieving educational goals as well as in allocating education funding. Additionally, the report supported adequate time for teaching as an essential factor in learning outcomes.

Subsequent educational initiatives have argued for an increase in instructional time by comparing the academic achievement and instructional time between countries. Supporters of increasing instructional time in the United States have often argued that American children rank near the bottom when comparing the number of days students attend school internationally (Barrett, 1990). The Third International Mathematics and Science Survey (TIMSS, 1999) compared eighth-grade mathematics achievement of students in South Korea and the United States. The survey found that eighth-grade students in South Korea attended school on average for 225 days and had a mean mathematics score of 587 while American eighth-graders attended school on average for 180 days of instruction with a mean mathematics achievement score of 502 (Mullis et al., 2001).

As reviewed by Long (2014), research has also been conducted regarding the impact on instructional time and educational attainment. Bellei (2009) examined an increase of academic achievement of students in Chile when the instructional time naturally increased by increasing the school day from a half-day to a full-day model. The study found a positive correlation between increased instructional time and increased student achievement in Chilean secondary schools. Kikuchi (2014) studied the impact of a revision of Japanese curriculum policy enacted in 1981 which reduced the total teaching hours by 445 or 0.5 years of total instruction in junior high schools. The study found a statistically significant relationship between the decrease in instructional time and a decrease probability for Japanese adolescent females to enroll in high school by 3-4% over the time period analyzed. The author concluded that the reduction in instructional time had a negative impact in later educational achievement for Japanese women.

As reviewed by Kikuchi (2014), Meghir and Palme (2005) examined the effect of increased compulsory schooling for children in Sweden based on policy reform in 1949 where the curriculum was consolidated to a national curriculum, as this reform replaced grade-based selection in junior high schools to a student choice of subject area of study. The authors found that the revision increased education at the post-compulsory level by approximately 3% as well as years of instruction by 0.298 years. Additional increases were noted for women's education where time spent in post-compulsory instruction was approximately 5%.

Research on instructional time specific to the timing of the academic year has also been conducted (Kikuchi, 2014). Pischke (2007) studied the impact of short school years due to educational reforms in Western Germany in the 1960's which changed to start of the academic year from spring to fall. The author found that a reduction in the weeks of instruction increased the probability of elementary grade retention. The study also found that the reform decreased the total instruction by approximately 0.3 years and decreased the likelihood of students enrolling in secondary school tracks. Kawaguchi (2013) analyzed the impact of Japanese policy reform that declared Saturday as a school holiday in 2002. The author found that the reform resulted in a reduction of time spent studying in junior high students. This was argued to result in an increased gap in test scores among students from different educational backgrounds, as students with less-educated parents were found more likely to be negatively impacted. The study concluded that intensive compulsory education assisted in creating equilibrium in opportunity for Japanese students from different economic backgrounds, where the additional instructional time was concluded to particularly benefit more at-risk students.

Conflicting Research on the Impact on Achievement

Although instructional time is often considered an integral factor in educational outcomes, research has found a limited and somewhat conflicting consensus on its causal effect on later outcomes (Kikuchi, 2014). The assumption that other countries outperform the United States simply because they spend more time in school has been contested by the literature (Joyner & Molina, 2011). Cross-sectional survey research within and between countries on instructional time has found a limited effect on achievement (Long, 2014). Other research specific to summer learning and natural experiments have concluded that time in school is an important variable on learning outcomes (Long, 2014). These contrary opinions are the result of differences in data as well as the way that instructional time has been defined (Long, 2014). Indicators of instructional time have ranged from the total number of school days in an academic year to the number of hours spent on a single subject (McMurrer, 2008). Developing a precise measure of instructional time has been difficult due to varying time spent on actual instruction as well as instruction efficiency (Baker et al., 2004).

Pischke (2007) examined the impact of revised school years in West Germany in the 1960's. The author found that a reduction in the weeks of instruction increased the probability of elementary grade retention and decreased the likelihood of students enrolling in secondary school tracks. However, the author did not find a negative impact between the shorter school years and earning potential or employment in adulthood (Kikuchi, 2014). Baker et al. (2004) argued that instructional time is an educational resource that does not warrant as much policy attention as it has received. The authors examined mathematics achievement data and instructional time between nations. Although a positive correlation was found between mathematics instruction and mathematics achievement for the countries of Greece, Japan, Poland, and the Republic of Korea, the majority of countries analyzed showed no relationship between mathematics hours and mathematics achievement. Additionally, the authors reported that international surveys on instructional time showed stronger small correlations between mathematics achievement where the average correlations at the national level for both mathematics and science were r = 0.14; no country had increased instruction associated with lower achievement in science. The authors gave recommendations to policymakers that resources should be used to improve teacher and curriculum initiatives as opposed to increasing instructional time at the national level. However, the authors also recommended that policymakers should address schools providing considerably less instructional time.

The data analyzed by Baker et al. in their 2004 analysis included those collected for the Third International Mathematics and Science Survey (TIMSS, 1999), and the Program for International Student Assessment (PISA, 2000). Interest of policymakers in studies conducted by the International Association for Evaluation of Educational Achievement (IEA), including TIMSS, has been growing in the past two decades (Drent, Meelissen, & van der Kleij, 2013). The TIMSS survey assessed eighth grade students across 38 nations in order to measure mathematics and science achievement trends (Baker et al., 2004). The survey found that eighth grade students in South Korea had higher achievement scores in mathematics and attended school longer in comparison to American eighth graders (Mullis et al., 2001). However, South Korea was not the leader in instructional time in mathematics when considering hours of mathematics instruction (Long, 2014). Moreover, the highest performing country on the TIMSS survey was Singapore, whose eighth graders scored an average of 604 in mathematics and attended school for 180 days a year (Long, 2014). The full TIMSS survey showed no statistically significant correlation between mathematics achievement and the length of the school year, nor between mathematics achievement and hours of instruction (Long, 2014).

On the contrary, Drent, Meelissen, and van der Kleij (2013) found significant effects of learning time on mathematics and/or science achievement when analyzing TIMSS data in regards to student self-rated attentiveness and extent of lesson interruption on instructional time. The authors found that such factors were associated with a negative effect on at least one country participating in the study on mathematics and/or science achievement in middle school students at <0.05. However, the countries demonstrating these negative effects were not named by the authors.

Additional studies have also found contradictions regarding the impact on increased instructional time and student achievement. Long (2014) conducted a meta-analysis of studies evaluating the impact of instructional time on student achievement as well as an updated analysis of international survey data. The author found no correlation between time in school and student achievement by further analyzing both 1999 TIMSS and 2000 Program for International Student Assessment (PISA) data. However, the author also re-examined data from the 2006 PISA survey while using improved measures of instructional time. Specifically, the author analyzed the average hours of instructional time per year, average hours spent in reading and mathematics class, and average hours spent doing mathematics or reading homework (Long, 2014). Contrary to the 1999 TIMSS and 2000 PISA, Long found a statistically significant effect of subject-specific instructional time, where an increase of 1 hour of reading and mathematics instruction increased achievement by 11% and 12% respectively at the school level. Moreover, the author argued that the analysis of 2006 PISA data indicated that increasing instructional time could dramatically counter the disadvantages of socioeconomic status on student achievement. The author noted that the definition of instructional time differed on the 2000 PISA and 2006 PISA surveys, where the 2006 PISA directly asked students their time spent on school lessons while the 2000 PISA relied on school administrator reports. The author concluded that the student reports were a more precise measure of subject-specific instructional time. As a result, the author determined that the length of the school year had no effect on academic achievement and the specific uses of time in school had a stronger influence on effective instructional time and academic achievement.

Joyner and Molina (2011) also examined the literature on the impact on instructional time on student achievement. The authors found that the impact of instructional time was not as important as how the actual time of instruction was spent. However, an increase of instructional time for at-risk students was found to have a positive correlation with increased achievement, particularly when analyzing the impact of summer vacation such as the study by Pennington (2006). The authors concluded that the impact of instructional time on student achievement was a complex issue within the literature, with no definitive or causal explanations.

When supported by research-based educational practices, the literature has supported extending learning time as an effective strategy for improving student achievement, particularly for student populations at risk for academic difficulties (Joyner & Molina, 2012). This sentiment was also mimicked by the meta-analysis by Long (2014), where the author found varying effects on instructional time in cross-sectional survey research within and between countries. Other research specific to summer learning and natural experiments have concluded that time in school is an important variable on learning outcomes, such as Marcotte (2007), Ginsburg and Chudowsky (2012), and Blank (2013).

Resource Availability and Academic Achievement

Resource availability is another topic within the literature that has been studied in order to demonstrate subsequent impact on academic achievement. Policies have also focused on the issue of expenses related to instruction. The states of Kansas, Georgia, Texas, and Louisiana have policies in place requiring a minimum of 65% of operating budgets be spent on classroom instruction, also known as the 65 Percent Rule (DeLuca & Hinshaw, 2013). This concept was authored and endorsed by First Class Education (2005) and included three objectives that would be met by implementing the 65 Percent Rule: increasing the amount of money spent in classrooms without tax increases; reducing the amount of money spent on non-instructional expenditures; and providing students with an elite education as indicated by increased student performance (Jones & Slate, 2010). However, little research exists to confirm his hypothesis that an increase of allotted instructional expenditure alone will result in increased achievement (DeLuca & Hinshaw, 2013). Further, research specific to the 65 Percent Rule is also rather limited (Jones, Bingham, & Jackson, 2007; Jones & Slate, 2010; Cullen, Jones, & Slate, 2011).

Despite policy initiatives that focus on financial resources and student achievement, the existence of a direct correlation between these factors has been variable (DeLuca & Hinshaw, 2013). Hanushek (1997) performed a meta-analysis of studies regarding student achievement and its relationship to school resources. The author concluded that a strong or consistent relationship between student performance and school resources was not evident amongst literature examined. The author also concluded that policies on financial resources alone was not a simple solution for improving achievement outcomes for students.

As reviewed by Jones and Slate (2010) and Cullen, Jones, and Slate (2011), Roper (1996) explored the relationship between student achievement and instructional expenditures of Alabama public school districts. The author found a curvilinear relationship between expenditures and achievement in Alabama school districts. The research found that school districts on the far ends of instructional costs were not found to have a correlation with student achievement on the Stanford Achievement Test (SAT). Correlations were found, however, for school districts in the middle range of spending.

As reviewed by Jones and Slate (2010) and Cullen, Jones, and Slate (2011), Tuner (1999) analyzed reading achievement data from Georgia from a sample of public school districts and its relationship with per pupil expenditure. The author found a moderate relationship between reading achievement in fifth graders and the expense per pupil. A stronger correlation was found by the author between reading achievement and the percentage of students receiving free or reduced lunch. Rodriguez and Slate (2009) analyzed differences amongst school districts in Texas in regards to accountability ratings on state assessments. The authors found that school districts with a rating of Academically Unacceptable were more likely to spend less per student in comparison to higher achieving school districts in Texas.

Other studies on the topic of resource availability and pupil expenditure have found minimal support for a direct correlation between these variables. A study was conducted by Standard and Poor's (2005) in attempt to analyze the impact of the 65 Percent Solution on student achievement. The study, which examined data from nine states, found no statistically significant relationship between student performance and instructional spending using linear regression (Cullen, Jones, & Slate, 2011). Jones et al. (2007) explored data from approximately 1000 school districts in Texas. The authors found no correlation between instructional expenditure ratio and academic achievement on state achievement measures.

DeLuca and Hinshaw (2013) analyzed the impact of expenditure distribution in school districts in Ohio and its prediction of student achievement. This study found that the most successful school districts in Ohio spent on average 56% of their operating budgets on instruction despite recommendations from the 65 Percent Solution. The use of percentage of instructional expenditure was found by the study to be a low or inconclusive predictor of student achievement. Further, the authors suggested that the school district income levels were a more useful predictor of student achievement in comparison to the percentage of the operating budget used on instructional practices in Ohio schools.

Other studies have found correlations between the percentage of instructional expenses and student achievement. Jones and Slate (2011) examined achievement data on the Texas Assessment of Knowledge and Skills (TAKS) assessment and percentage of instructional expenditures in Texas school districts. The authors found that school districts that spent less than 60% on instructional expenditures had the lowest percentage of passing rates on the TAKS assessments in reading, mathematics, social studies, science, and writing. The authors concluded that the study results did not provide an overall conclusion on the direct impact of finances on student achievement. However, the authors suggested that the financial variable is one to consider as having potential impact on student achievement, where additional research regarding the extent of the financial impact is necessary.

Interaction Density and Academic Achievement

Research has also been conducted on the impact of the interaction density within schools and subsequent academic achievement. This is often studied using the ratio of students to teachers. Mosteller (1995) conducted a longitudinal study on the effect of Tennessee class size initiatives in elementary grades. The author analyzed data collected from Tennessee's Project STAR (Student-Teacher Achievement Ratio), Lasting Benefits Study, and Project Challenge. These project phases included on-going data collection on the impact of student-teacher ratio on academic achievement in the 1980's and 1990's. Project STAR analyzed the performance of 80 schools in the areas of reading, mathematics, and study skills that compared class sizes of 13 to 17 to those of 22 to 25 students in kindergarten through third grade. Data from this project found that smaller classes produced improvement in all areas of achievement, where the effect of smaller classes was nearly double for minority children in the early grade levels. The greatest gains of Project STAR were found in kindergarten through first grade students and the initial gains were both maintained and enhanced through third grade (Nye et al., 1992).

Mosteller (1995) also analyzed longitudinal data from subsequent initiatives from Tennessee Project STAR. The next phase of the Tennessee Project STAR was called the Lasting Benefits Study. Data collected from this phase found that students who were originally enrolled in the smaller sized classes continued to perform better on achievement assessments in later grades when included in average class sizes in comparison to their counterparts. The final phase, called Project Challenge, analyzed data from the 17 most economically disadvantaged schools included in Project STAR that were given small-class sizes in kindergarten through third grade. These findings showed that the included schools increased their Tennessee rankings from below average to above average in reading and mathematics.

The findings from Tennessee's Project STAR and subsequent phases demonstrated a positive impact on student achievement as the result of decreasing class sizes, particularly for students in the primary grades (Nye et al., 1992). The effects of lower student-teacher ratios on student achievement were also found to have beneficial outcomes on student achievement of minority and at-risk students in Tennessee (Finn, Suriani, & Achilles, 2007). As a result of the findings from these Tennessee class size initiatives, other states had followed class size reduction initiatives, some of which were mandatory; federal efforts such as wording in NCLB (2002) that include Title II funding incentives also followed suit (Rodriguez & Elbaum, 2014). The average student-teacher ratio nationally for the 2010-2011 academic year was 1:15.7 and for the 2011-2012 academic year as 1:16.0 (National Education Association (NEA), 2012; Fassbender & Lucier, 2014).

Additional studies have found similar findings on the positive effect of lower student-teacher ratios on academic achievement. Iversen and Tunmer (1993) studied the effectiveness of one-on-one and small-group interventions in reading. The authors found evidence to support a lower student-teacher ratio in reading interventions as they resulted in better outcomes for first graders at risk for reading difficulties. Vaughn et al. (2003) compared reading outcomes for students in interventions delivered in three grouping formats: 1:1, 1:3, and 1:10 in teacher-led instruction. The authors found that the smaller intervention group sizes (1:1 and 1:3) led to significantly higher gains in phoneme segmentation, fluency, and comprehension than the larger group size (1:10). No difference in gains was noted between the 1:1 and 1:3 intervention delivery models by the authors. On the contrary, Schwarts, Schmitt, & Lose (2012) in their comparison of reading achievement for at-risk first grade students in 1:1, 1:2, 1:3, and 1:5 intervention modalities found a trend analysis of a reduction in achievement as group size increased. The authors found the 1:1 condition yielded significantly higher outcomes.

As reviewed by Retner et al. (2011), Begeny et al. (2011) studied the effects of group intervention sizes in second graders on reading achievement, where the impact of 1:1, small-group (1:6), and peer-dyad interventions were examined. The authors found that students receiving 1:1 or small-group instruction had greater gains in reading fluency in comparison to the peer-dyad modality. Similar findings were demonstrated by Ross and Begeny (2015) in their examination of student-teacher ratio and intervention durations in reading fluency achievement. The authors found that although a longer intervention duration had better outcomes in comparison to shorter intervention durations, there was a minimal difference in the effectiveness of oral reading interventions between small-group and 1:1 modalities.

The effects of student-teacher ratio on mathematics achievement is more limited in the literature in comparison to reading achievement. The outcome data from the Tennessee Project STAR and follow-up phases were consistent with mathematics achievement outcomes for students within the primary elementary grades (Nye et al, 1992). On the contrary, an analysis of TIMSS (1999) data by Akyuz and Berberoglu (2010) at the international level found a positive correlation between class size and mathematics achievement scores; as class size increased so did mathematics achievement. The authors contributed this finding to the assumption that lower achieving students were more often assigned to smaller classes which likely included students with disabilities. However, a difference in mathematics achievement was noted by the authors between European Union countries, which had an average class size of 22, and the country of Turkey with an average class size of 42; countries in the European Union had significantly higher mathematics achievement in comparison to Turkey. The authors concluded that neither larger class sizes, nor those with very few students resulted in better educational outcomes in international comparisons.

Additional research regarding interaction density has also been conducted in regards to the size of the physical building and academic achievement. Swift (2000) examined the relationship between school density and achievement test scores in the state of Georgia on the Iowa Tests of Basic Skills (ITBS) in third graders. The author found that elementary schools with lower architectural square footage (less than 100 square feet per student) had significantly lower assessment scores in the areas of science, social studies, and overall composite scores in comparison to elementary schools with architectural square footage of 100.27 to 134.1 per student. The author suggested that the availability of resources may have played a role in achievement differences noted in the study.

The use of technology has grown as an intervention tool for educators as an attempt to provide more one-on-one support for students (Fassbender & Lucier, 2014). Dunlevy and Heinecke (2007) examined the effectiveness of 1:1 computer-based interventions in mathematics and science for middle school students. Although significant program effects were found regarding science achievement on post-assessment measures, no significant effects were found by the authors for mathematics achievement following the 1:1 laptop computer intervention. The authors cautioned the investment in such intervention delivery models in mathematics as further research on the efficacy and delivery was necessary. This sentiment was reflected in a study by Aztekin and Yilmaz (2014) in their analysis of human and material resources on international mathematics achievement on the 2012 Program for International Student Assessment (PISA). The authors recommended that government entities should find ways to improve computer-based and instructional materials as well as developing and retaining effective teachers.

Population Density and Academic Achievement

The relationship between school district population density and academic achievement is another variable that has been examined within the literature. A focus of the research regarding population density has been a comparison of schools located in differing demographic areas including rural and urban populations. Multiple studies have concluded that students from urban areas perform better on standardized achievement tests in comparison to students from rural areas (Borland & Howsen, 1999).

Explanations for these measured differences have included theories regarding different economic factors and access to resources, value in the data obtained, and the effects of location in the value of obtaining an education (Borland & Howsen, 1999). DeYoung (1985) examined the educational performance of students in the state of Kentucky and found that increased income from mining in the Appalachian region to be associated with below average achievement and a lower expense per pupil in comparison to state areas less dependent on the mining industry. Broomhall and Johnson (1994) examined students from rural areas. The authors found that students who were less willing to move along with a less positive perception of local employment opportunities tended to have a more negative perception of the need for education and performed more poorly in school in comparison to students who were more willing to move from their rural areas. Broomhall (1995) followed up this study and concluded that both economic and social conditions in the Appalachian region of the United State were below those of the rest of the country. The author hypothesized that a lack of personal investment in education may be a factor in the economic conditions at that time. Such conclusions have been incorporated into programs developed to improve academic achievement in rural areas. These include the Appalachian Rural Systematic Initiative (ARSI), where a focus includes improving access to information and expertise similar to those available in suburban communities (Harmon & Blanton, 1997).

Additional research comparing the performance of schools in rural and urban areas has found a more comparable rates of achievement between urban and rural students, particularly in comparison to more moderate population densities. Borland and Howsen (1999) compared the academic performance of students from rural and urban areas to those from areas of moderate population density in the state of Kentucky, as the state had varying ratios of density of 21 people per square mile to 7,774 people per square mile. The authors found that third grade students from both rural and urban population densities had similar levels of cognitive ability and academic achievement. Further, the authors found that students from areas of moderate population density outperformed their rural and urban counterparts on such assessments.

The authors concluded that policies aimed at improving student achievement should not be aimed at improving achievement in one population setting. Rather, policies should be aimed at improving access to resources across population domains to increase incentives for educational outcomes.

Additional research on population setting differences has found similar results. Graham and Provost (2012) examined population density and its relationship with mathematics achievement in kindergarten students by analyzing data for the Early Childhood Longitudinal Study, which included information from 22,000 school-age children from 1998 to 2006 across the United States. The authors found that rural and urban kindergarteners were found to have slightly lower mathematics achievement in comparison to suburban kindergarteners. Increases for mathematics achievement from kindergarten to eighth grade for rural and urban students was also smaller compared to their suburban counterparts. The authors concluded that these performance differences between rural/urban and suburban students were contributing to the achievement gap within the United States. They also suggested the family socioeconomic status may play a major role in these observed differences between populations.

Further research on population density and academic achievement has also been conducted with a focus on urban settings. Gottfried and Johnson (2014) examined standardized achievement scores on the Stanford Achievement Test – 9th Edition (SAT9) in reading and mathematics for elementary students in the School District of Philadelphia at the student, classroom, and school-level. The study found variance between student achievement on the SAT9 in elementary students in both reading and mathematics. However, the majority of the variation was found within classrooms (or student-level) in comparison to classroom-level and school-level variations of achievement scores in reading and mathematics. Otherwise stated, the results were more homogenous across classroom and elementary school-levels in comparison to variance examined at the student-level. The authors suggested that factors such as parental involvement, social capital, and educational expectations may be factors in variance.

Comparisons of student academic achievement from rural and urban backgrounds have also been conducted at the international level. Liao, Chang, Wang, and Horng (2013) compared the impact of college admission incentive programs in Taiwan for rural students, and compared the college academic performance to their urban counterparts. The authors had found that students from rural areas in Taiwan were under-represented at more selective universities despite reforms aimed at the issue. It was argued that a decreased expectation of lower academic performance by rural students compared to urban students may have played a role in this finding. Despite this argued perception, the authors found that students from rural areas outperformed their urban counterparts when comparing student grade-point averages from the first semester of their freshman year. The authors recommended that their results be considered for other countries attempting to balance urban-rural admission differences at selective universities.

Proficiency Status and Academic Achievement

As the result of the No Child Left Behind Act (NCLB, 2001), school districts nationally have been mandated to demonstrate adequate yearly progress (AYP) in order to show accountability for their educational practices. Group-administered achievement assessments have been utilized by states and school districts alike across the country since the passage of NCLB. School districts which did not meet AYP standards and growth risked potential financial consequences, state takeover, and even closing of underperforming schools (Shapiro, Salari, & Petscher, 2008). In addition, some states, as well as school districts, have associated student achievement on standardized state assessments with salary increases, teacher evaluations, and even grounds for teacher termination (Amrein & Berliner, 2002; Ferchalk, 2013). The longer a school is unsuccessful in its attempts to meet AYP towards state standards of proficiency, the more intense the consequences of corrective action (Wong, Cook, & Steiner, 2011). As a result, many school districts have aligned their curricular practices and implementation materials with the defined state standards in reading and mathematics. Moreover, many have also utilized state assessment scores as benchmarks for achievement growth for students, schools, and school districts.

The research literature has demonstrated an increase in student achievement as the result of policy initiatives and school-based accountability pressure (Lauen & Gaddis, 2012). The implementation of standards-based policies and instructional practices has resulted in significant gains in mathematics achievement, where these gains were strongly related to the strength of assessment policies at the state level; positive gains have also been noted in reading achievement (Swanson, 2006). Carnoy and Loeb (2002) examined the impact of eighth grade student gains on the National Association of Education Progress (NAEP). Specifically, the authors examined assessments in mathematics between state differences in the use of high-stakes tests to sanction and/or reward schools. The authors found that students in high-accountability states had significantly greater mean gains in mathematics as measured by the NAEP assessment in comparison to students in states with little or no state initiatives aimed at improving student performance. No differences in student retention or high school graduation rates were indicated. Additional analysis of NAEP assessment data by Hanushek and Raymond (2004) regarding the impact of federal accountability policies at the state level also found subsequent improvement gains in demonstrated academic achievement.

Dee and Jacob (2011) also analyzed the association of policy initiatives of high-stakes testing with student achievement by analyzing test scores from the NAEP assessments in fourth grade. State performances were examined by the authors by comparing those states with school accountability policies in place prior to NCLB to states that did not. The authors found statistically significant increases in the mean mathematics performances of fourth graders after the implementation of NCLB with an effect size of 0.23 by the year 2007, where improvements in eighth grade mathematics achievement was also indicated (Dee & Jacob, 2011). However, the author did not find evidence of increased reading achievement in fourth grade as the result of the passage of NCLB. Similar results were found by Wong et al. (2011) in their analysis of NAEP data across states, where gains were also found in mathematics achievement in fourth and eighth grade students as the result of accountability initiatives. However, a positive impact of such initiatives was not associated with achievement gains in reading according to the authors.

Reback, Rockoff, and Schwartz (2011) examined and compared state data in determining AYP and its impact on school personnel and student achievement. The authors found increases on student achievement on high-stakes testing. However, the authors found that accountability initiatives varied between states in proficiency definitions and were also associated with lower perceptions of job security amongst teachers. The researchers also found that pressure associated with NCLB accountability initiatives at the state-level did not have a negative effect on student learning or their enjoyment in the learning process.

Other research has focused on the impact of policy initiatives on student achievement at that state-level. Figlio and Rouse (2006) studied the impact of vouchers on student achievement in Florida schools considered to be low performing on state assessments. The researchers found large improvements in both reading and mathematics as measured by state assessments since policies associated with the threat of school vouchers were initiated. Further, measured gains in the study were also associated with changing student characteristics as well as the reputation and low expectations of being labeled a low performing school in Florida. Jacob (2005) examined the impact of accountability policies mandating demonstrated AYP on reading and mathematics achievement on state assessments in the Chicago Public Schools. The author found that reading and mathematics achievement increased following the implementation of accountability policies when comparing performance data from before and after their enactment (Jacob, 2005). An item-level analysis also suggested that an increase in assessment-specific skills also had an impact on achievement gains in reading and mathematics. The author also argued that such gains may have also been the result of other strategies utilized by schools as a result of policy initiatives, including student retention and a decrease in subjects such as science and social studies. Reback (2008) mimicked similar findings in an analysis of Texas state assessment data and student achievement. The author found that student achievement increased when their state assessment performance was particularly important to their school’s accountability rating. Moreover, the author found the effects of the high-stakes testing and student performance appeared to be associated with changes in school resources and instructional practices, where school attempts to target specific students in order to increase assessment scores were also noted.

Although the research literature generally support the notion that state accountability measures have resulted in gains in student achievement, criticism of these initiatives has been noted in regards to generalizability of these gains across student performance groups. Booher-Jennings (2005) explored the Texas Accountability System and school responses to the initiative. The author found that such accountability measures resulted in urban schools utilizing triage practices to aim resources more at students believed to be on the verge of passing the state assessment as well as increasing referrals for special education services. On the contrary, Hanushek and Raymond (2005) found that special education placements did not rise in an analysis of national data as a result of accountability standards. However, the authors did find that accountability standards such as NCLB have not led to a decrease in the achievement gap between African American and Caucasian students. A slight decrease in the achievement gap between Hispanic and Caucasian students was also noted by the authors.

Ladd and Lauen (2010) analyzed 10 years of student-level data yielded by state assessments in North Carolina. The authors found achievement gains in students below proficiency levels with higher effects in math compared to reading. The authors did not find evidence to support claims of accountability initiatives resulting in the triage of resources bypassing the lowest performing students. The authors did find that accountability practices had the least amount of growth in reading achievement for the highest performing students. Lauen and Gaddis (2012) also found that accountability initiatives and increased academic standards in North Carolina benefitted students near grade level more than low or high achieving students in mathematics; high achieving students benefitted the least from such standards compared with near or below grade-level peers in reading. Neal and Schanzenbach (2010) found similar findings in their analysis of Chicago Public Schools state testing data. The authors found that the lowest achieving Chicago students in fifth grade did not score higher in math or reading as a result of accountability initiatives. Such criticisms of accountability systems based on status of performance have led to states adopting accountability standards based upon student growth models (NEA, 2009). For example, the Commonwealth of Pennsylvania adopted this standard of accountability beginning with the 2013-2014 school year. The School Performance Profile continues to inform school district constituents of the academic performance and proficiency as well as resources to help improve school performance (PDE, 2015).

Summary

This chapter has presented relevant literature on instructional time and its effects on achievement. A background on educational policies was introduced and discussed as well as a comparison of national trends regarding instructional time. Literature comparisons on the importance of instructional time and its role in student achievement were explored, as well as opposing opinions on the impact of instructional time. Literature regarding natural consequences, such as state initiatives, summer break, weather cancellations, and calendar changes, indicated an impact on academic achievement in multiple studies. International comparisons were also examined. Other researchers argued that the importance of instructional time is too heavily emphasized in educational policies and reform measures. When supported by research-based educational practices, the literature has advocated extending learning time as an effective strategy for improving student achievement, particularly for student populations at-risk for academic difficulties (Joyner & Molina, 2012). In addition, the review of literature also explored the role of resource availability, interaction density, population density, and proficiency status on academic achievement outcomes. In summary, the review of literature provides a foundation base in support of this study.

CHAPTER THREE

METHODS

The purpose of this study was to examine the varying instructional time across four academic school years and the resulting school district third grade proficiency rates in reading and mathematics on the Pennsylvania System of School Assessment (PSSA). Specifically, this research study set out to determine the following:

(1) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area reading in third grade?

(2) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area mathematics in third grade?

(3) Do any associations exist among the following variables: resources availability, population density, interaction density, and school district annual yearly progress status?

The following sections will review the specific methods planned for this study. They will include a design of the study and the corresponding research path diagram, the study population, assignment procedures, and sources used to obtain data. A review of the statistical analysis planned to be utilized, including a 5-way analysis of variance (ANOVA), will also be explored.

Design

This study utilized a pre-experimental design. Data for this study will be collected through the use of archival data available from the Commonwealth of Pennsylvania through the Pennsylvania Department of Education (PDE) made public through their website or through the Pennsylvania

Information Management System (PIMS). The average weeks of instruction prior to the administration of the Pennsylvania System of School Assessment (PSSA) were calculated for the 2009-2010, 2010-2011, 2011-2012, and 2012-2013 academic years, because the testing windows varied in time frame among these years (e.g. March testing window versus April testing window). School district PSSA assessment data from the 2009-2010, 2010-2011, 2011-2012, and 2012-2013 academic years was also analyzed. Proficiency percentages were converted to z-scores for analysis purposes. Data investigated also included the school district resource availability measured by expenditure per pupil as well as state aid ratio made available by the PDE by academic year; school district population density measured by the urban-centric code system made available from the PDE by academic year; school district interaction density measured by student/teacher ratio made available by the PDE by academic year; and school district AYP status made available by the PDE by academic year. See Figure 2 for a Research Path Diagram of the present study.

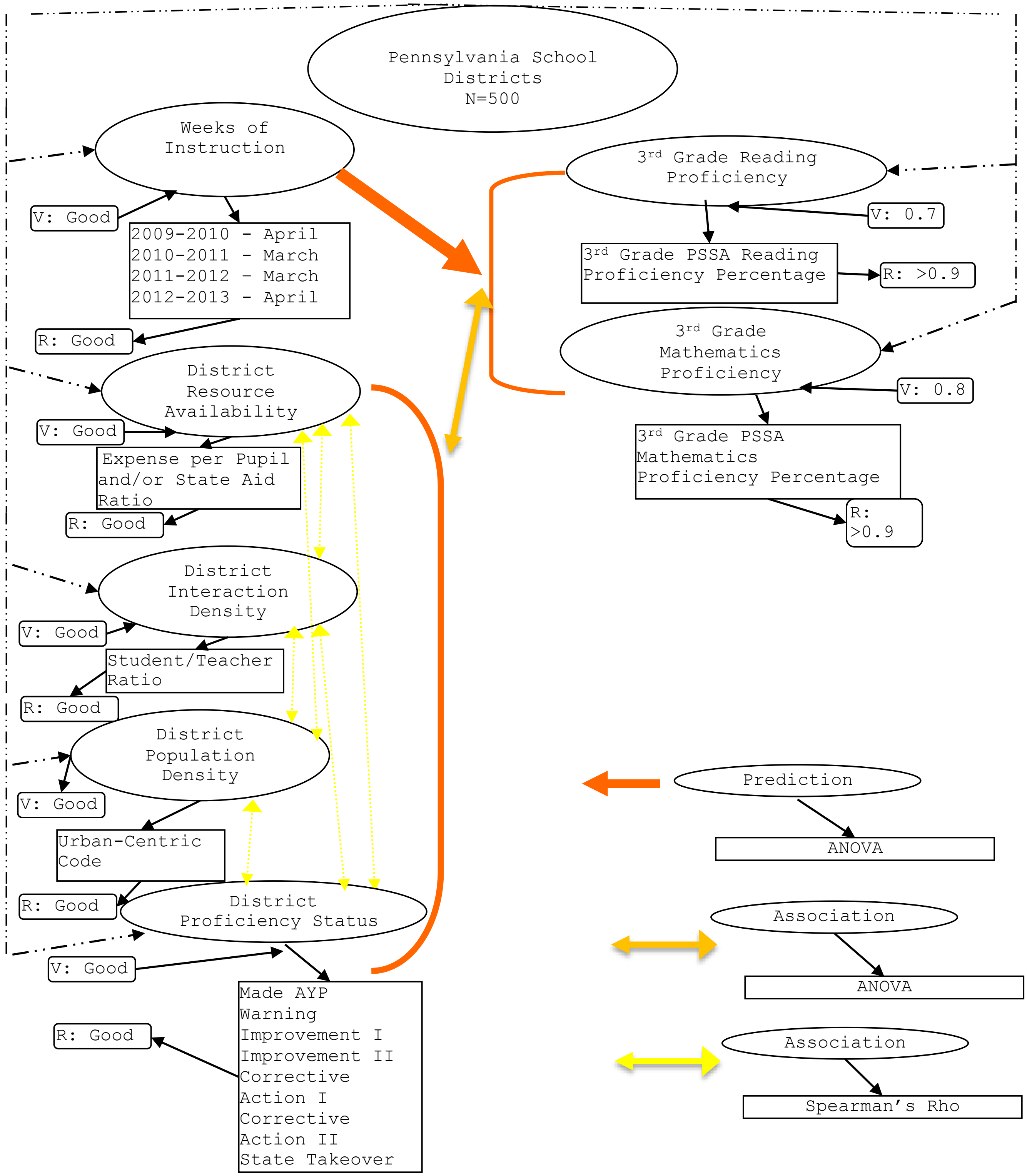

Figure 2. Research path diagram of the project.

Population

The population used in this study was the 500 school public school districts in the Commonwealth of Pennsylvania. These public school districts are mandated by federal legislation to administer assessments to monitor student achievement in the areas of reading and mathematics. Pennsylvania uses the PSSA assessment in order to assess student acquisition and retention of reading and mathematics skills. School district data concerning reading and mathematics proficiency were analyzed regarding achievement in third grade students amongst the public school districts in the Commonwealth of Pennsylvania.

Sample

The sample for this study is better defined as the study population. The population planned for analysis included all 500 public school districts in the Commonwealth of Pennsylvania. Because each school district is mandated to participate in PSSA assessments, each school district was analyzed using third grade proficiency rates in reading and mathematics, along with other variables, in this study.

Measurement

The two dependent variables for the study were school district third grade proficiency rate percentages in reading and in mathematics on PSSA assessments. The data collected was interval data. PDE has established scale score benchmarks to define individual student proficiency rates in the areas of reading and mathematics in the Technical Report for the PSSA (2008). The benchmark scale scores in the area of reading for third grade are defined as follows: Advanced/Proficient 1442; Basic/Proficient 1235; and Below Basic/Basic 1168 (Data Recognition Corporation, 2008). The benchmark scale scores in the area of mathematics for third grade are defined as follows: Advanced/Proficient 1370; Basic/Proficient 1180; and Below Basic/Basic 1044 (DRC, 2008). These established benchmark scale scores, which were established by PDE in 2007, have been the benchmark utilized to define proficiency rates in reading and mathematics for third graders in Pennsylvania since this time. Despite the testing windows varying between academic school years, the quantitative definition established by PDE has not changed to accommodate fluctuating weeks of instructional between school years, where the same cut scores were defined in the 2013 Technical Report (DRC, 2013). These variables were selected because each school district in Pennsylvania has been mandated to participate in the PSSA assessment in reading and mathematics in third grade. Moreover, school district proficiency rates on PSSA assessments in reading and mathematics are reported annually by the state. Additionally, third grade proficiency rates in reading and mathematics were specifically chosen because third grade is the first year that students begin participating in PSSA assessments. As reported to the Central Susquehanna Intermediate Unit by the Human Resource Research Organization (Thacker, 2004), the DRC, which is the testing contractor of PDE, reported high reliability coefficients of greater than 0.9 for PSSA assessments in reading and mathematics. Validity coefficients of approximately 0.8 for mathematics and 0.7 for reading were reported regarding convergent validity in comparison to other norm-referenced assessments such as CTBS/Terra Nova assessments (Thacker, 2004). There were no independent variables analyzed in this study.

There were five ancillary variables analyzed as part of the study. These variables included weeks of instruction prior to PSSA assessment administration, district resource availability, district population density, district interaction density, and district AYP status.

The first ancillary variable for the study was the weeks of instruction prior to the administration of PSSA assessments. The data collected was ratio data. The weeks of instruction for the corresponding academic school years of 2009-2010, 2010-2011, 2011-2012, and 2012-2013 were analyzed.

Moreover, the testing windows for PSSA were used to calculate the weeks of instruction prior to the administration of PSSA assessments along with the first student day of the school year for each school district. Pennsylvania requires school districts to provide 180 days of instruction, including 900 hours of instruction for elementary students (Romeo, 2014; PDE, 1997). As such, school district calendar information is archived by PDE in order to track district compliance with this mandate, including the start date for students for the corresponding academic year. This information was requested and collected through public domain on PIMS through PDE. PDE has also outlined the testing windows for school districts in their PSSA handbooks distributed annually. The testing window for PSSA assessments in reading and mathematics during the 2009-2010 academic year was in April 2010. The testing window for PSSA assessments in reading and mathematics during the 2010-2011 academic year was in March 2011. The testing window for PSSA assessments in reading and mathematics during the 2011-2012 academic year was in March 2012. Finally, the testing window for PSSA assessments in reading and mathematics during the 2012-2013 academic year was in April 2013. The dates were outlined in the PSSA technical manuals for the corresponding academic years. These academic years were chosen as they each had differing testing windows (or different months) between assessment administrations. These testing windows were selected because they were the date ranges provided by PDE to the school districts for each academic year. Because weeks of instruction for each academic year was calculated using the school district start date and corresponding testing window outlined by PDE, validity and reliability are both excellent for this variable.

District resource availability was examined in order to analyze its relationship with proficiency rates in reading and mathematics, as measured by the PSSA assessments. Data collected was ratio data. District resource availability was measured by district student expenditure by average daily membership as well as market value/personal income aid ratio during the corresponding academic year. This information was reported by school districts annually to PDE, which in turn reported this information to the public via the PDE website. The validity and reliability for district resource availability are both excellent.

District population density was also examined in order to analyze its relationship with proficiency rates in reading and mathematics, as measured by the PSSA assessments. The data collected was ordinal data. This ancillary variable was measured using the urban-centric locale system utilized by PDE. The urban-centric locale system classifies all the school districts in Pennsylvania into 1 of 12 locale codes. The urban-centric locale codes are defined as follows: City-Large, City-Midsize, City-Small, Suburban-Large, Suburban-Midsize, Suburban-Small, Town-Fringe, Town-Distant, Town-Remote, Rural-Fringe, Rural-Distant, and Rural-Remote. This information was available through the PDE website. The validity and reliability for district population density are both excellent.

District interaction density was also examined in order to analyze its relationship with proficiency rates in reading and mathematics, as measured by the PSSA assessments. Data collected was ratio data. District interaction density was measured by the school district student/teacher ratio during the corresponding academic year. Student/teacher ratio was calculated by school district average daily membership divided by the number of teachers in each school district. Information regarding the number of students attending as well as the number of teachers employed by each school district is reported to PDE annually. Information regarding the average daily membership for each school district for the corresponding academic year was available on the PDE website. The number of teachers employed by each school district for the corresponding academic years was requested and collected through public domain on PIMS through PDE. The validity and reliability for district interaction density are both excellent.

Finally, district proficiency status was examined in order to analyze its relationship with proficiency rates in reading and mathematics, as measured by the PSSA assessments. Data collected was ordinal data. The state assigned each school district to 1 of 7 categories regarding AYP based upon their PSSA results from the previous school year for the academic years analyzed. Proficiency status was defined as follows: Made AYP, Warning, School Improvement I, School Improvement II, Corrective Action I, Corrective Action II, and State Takeover. This information was available through the PDE website. The validity and reliability for district proficiency status are both excellent. See Table 5, Table 6, and Table 7 for an outline of the measurements.

Table 5

Latent Variables, Observed Variables, Instrument/Sources, Validity and Reliability for Research Question 1: "Do any of the Following Variables Predict the Proficiency Rate in the Area of Reading in Third Grade?"

Latent Variable	Observed Variables	Instrument /Sources	Validity	Reliability
Weeks of Instruction	2009-2010 2010-2011 2011-2012 2012-2013	PDE Archival Data	Excellent	Excellent
District Resource Availability	Expense per Pupil and State Aid Ratio	PDE Archival Data	Excellent	Excellent
District Population Density	Urban-Centric Code	PDE Archival Data	Excellent	Excellent
District Interaction Density	Student/ Teacher Ratio	PDE Archival Data	Excellent	Excellent
District Proficiency Status	Made AYP Warning Improvement I/II Correct Action I/II State Takeover	PDE Archival Data	Excellent	Excellent

Table 6

Latent Variables, Observed Variables, Instrument/Sources, Validity and Reliability for Research Question 2: "Do any of the Following Variables Predict the Proficiency Rate in the Area of Math in Third Grade?"

Latent Variable	Observed Variables	Instrument /Sources	Validity	Reliability
Weeks of Instruction	2009-2010 2010-2011 2011-2012 2012-2013	PDE Archival Data	Excellent	Excellent
District Resource Availability	Expense per Pupil and State Aid Ratio	PDE Archival Data	Excellent	Excellent
District Population Density	Urban-Centric Code	PDE Archival Data	Excellent	Excellent
District Interaction Density	Student/ Teacher Ratio	PDE Archival Data	Excellent	Excellent
District Proficiency Status	Made AYP Warning Improvement I/II Correct Action I/II State Takeover	PDE Archival Data	Excellent	Excellent

Table 7

Latent Variables, Observed Variables, Instrument/Sources, Validity and Reliability for Research Question 3: "Do any Associations Exist Amongst the Latent Variables?"

Latent Variable	Observed Variables	Instrument /Sources	Validity	Reliability
District Resource Availability	Expense per Pupil and State Aid Ratio	PDE Archival Data	Excellent	Excellent
District Population Density	Urban-Centric Code	PDE Archival Data	Excellent	Excellent
District Interaction Density	Student/ Teacher Ratio	PDE Archival Data	Excellent	Excellent
District Proficiency Status	Made AYP Warning Improvement I/II Correct Action I/II State Takeover	PDE Archival Data	Excellent	Excellent

Procedure

Existing archival data from the PDE was examined in this study. The data included school district PSSA proficiency rates in third grade reading and mathematics for the 2009-2010, 2010-2011, 2011-2012, and 2012-2013 school years; weeks of instruction prior to the administration of PSSA assessments for the corresponding academic years; school district expense per pupil; school district aid ratio; school district urban-centric code; school district student/teacher ratio; and school district proficiency status. This information has been made available through the PDE website and/or PIMS as archival information available to the public.

The examiner organized and obtained the majority of the state archival data analyzed in this study via the PDE website. School district start dates as well as the number of teachers employed by each school district was made available to the examiner through PIMS by PDE as public information. The Pennsylvania New Right to Know Law of 2008 provides access to citizens of the Commonwealth access to public information and provides report by state-related institutions (PNRKL; 2008). PDE, as well as Commonwealth school districts, fall under the jurisdiction of the New Right to Know Law as state-related institutions of education (PNRKL; 2008). The examiner converted the archival data from ratio or interval data to ordinal data for the ancillary variables as necessary for analysis purposes for each of the variable to be examined. See Table 8 for an outline of the events scheduled to occur during the implementation of this study

Table 8

Year of Administration/School District Proficiency in Reading and Math Project Task Table

#	Name	Description	Begin	End	Person(s)
1	Reason for project	Based upon research interests, investigate the relationship between the annual PSSA testing window and third grade proficiency rates in reading and math across Pennsylvania school districts.	10-14	09-16	School psychologist, research consultant
2	Refine Study Design	Review reading and mathematics proficiency guidelines for the state as well as other states. Write dissertation prospectus outline. Hold dissertation prospectus meeting with committee. Obtain IRB approval for study.	10-14	12-14	School psychologist, research consultant, research committee
3	Review of Literature	Review literature base regarding state assessment practices, instructional time, and associated achievement proficiency rates in reading and math among ancillary variables (e.g. district resources, population density, interaction density, and AYP status).	12-14	03-15	School psychologist, research consultant
4	Data Collection	Obtain reading and mathematics proficiency percentage data for corresponding academic years in study as well as testing windows/weeks of instruction, expenditure per pupil, students per square mile, student/teacher ratios, and AYP status regarding all public school districts in the Commonwealth of Pennsylvania for academic years to be examined.	10-15	12-15	School psychologist, research consultant, state data base manager

#	Name	Description	Begin	End	Person(s)
5	Data Entry	Collect and organize data to be analyzed from PDE. Make requests for additional data if needed. Review and code.	11-15	4-16	State data base manager, school psychologist, research consultant
6	Final Report Preparation	Obtain data from the data base project system. Review data. Examine data to see if it meets the assumptions for the analysis. Run the analysis. Interpret analysis results. Write the report.	05-16	08-16	School psychologist, state data base manager, research consultant
7	Final Report Review	Meet with all parties to review and refine the final report.	08-16	09-16	School psychologist, state data base manager, principal, research consultant
8	Final Report Presentation	Revise final report if needed per suggestions of committee. Make final submission to university.	09-16	10-16	School psychologist

Sample Size

The sample size is 499 of the 500 of the public school districts in the Commonwealth of Pennsylvania. This sample was chosen because it included the school district population that administers PSSA assessments to third grade students in reading and mathematics during the testing windows provided by PDE annually, including the 2009-2010, 2010-2011, 2011-2012, and 2012-2013 school years academic years. One school district was excluded from analysis due to not having available data for many of the ancillary variables as well as the outcome variables.

Statistical Analyses

The following research questions will be investigated and their corresponding statistical analyses will be discussed. The Statistical Passage for the Social Sciences (SPSS) and Statistical Analysis System (SAS) software programs were used to analyze the data. For the weeks of instruction variable, the data was coded to represent the short academic years (2010-2011 and 2011-2012) and the long academic years (2009-2010 and 2012-2013) prior to the administration of PSSA assessments. The shorter academic years were coded as "O" while the long academic years will be coded as "1". "0" represented the two short academic years combined while the "1" represented the long academic years combined.

For the district resource availability and district interaction density latent variables, the data were converted to ordinal data by examining frequency distributions for each school district. An average for the shorter academic years where the PSSA assessments were administered in March (2010-2011 and 2011-2012) as well as an average for the longer academic years where the PSSA assessments were administered in April (2009-2010 and 2012-2013) were planned to be calculated. For the latent variables of district population density and district AYP status, an average for the shorter academic years where the PSSA assessments were administered in March (2010-2011 and 2011-2012) as well as an average for the longer academic years where the PSSA assessments were administered in April (2009-2010 and 2012-2013) were also planned to be calculated. The sample size for each category were examined to determine if any categories needed to be combined.

Once the data conversions for each latent variable were applied, all of the research questions were to be explored using 5-way Analysis of Variance (ANOVA): one for reading proficiency and one for math proficiency. Effect sizes and p-values of all variables were planned to be inspected and the strongest predictors and/or associations of school district reading proficiency and mathematics proficiency in third graders were anticipated to be revealed. Two 5-way ANOVAs were planned to examine the five categorical variables, main effects, and dimensions and the relationship with the third grade reading and math proficiency. The 5-way ANOVA planned to have five between dimensions.

Research Question 1

It was hypothesized that the weeks of instruction would predict the proficiency rate in the area of reading in third grade on PSSA assessments, where reading proficiency would be positively correlated with the amount of instruction prior to the assessment administration. The variables involved with this research question included the weeks of instruction during the year of administration and reading proficiency. An average of the weeks of instruction for the two years in which the PSSA assessments were conducted in March (hereon defined as short instruction years) as well as an average for the two years the PSSA assessments were conducted in April (hereon defined as long instruction years) for each school district were calculated. The average for each variable and district was analyzed. A 5-way ANOVA was planned to determine the effect size and p-value coefficients of the variables in order to determine strength of the prediction between the variables. It was assumed that the dependent variable data used in the ANOVA was interval/ratio/absolute data, that normality was present, equal variances were present, and the ancillary variable data were linear. The following steps were be taken in order to examine the appropriateness of these assumptions: review the data, use descriptive statistics in SPSS, look at a histogram, and examine pairwise comparisons within a scattergram. The effect sizes and p-value coefficients were examined to determine the strengths of the prediction once the assumptions have been checked.

A 5-way ANOVA was planned to examine differences in the outcome variables which were related to the predictor variables. It was assumed that the data used in the ANOVA were normally distributed with equal variances. The following steps were be taken in order to examine the appropriateness of these assumptions: review the data, use descriptive statistics in SPSS, and look at a histogram. It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in reading in third grade, where stronger associations would be present in school districts with greater resource availability. It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding reading proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. Additionally, it was hypothesized that school district interaction density would predict reading proficiency, where school districts that had lower student teacher ratios would have higher reading proficiency in third grade. Finally, it was hypothesized that school district proficiency status would predict reading proficiency, where school districts that had met AYP standards would have higher reading proficiency in third grade.

Together, a 5-way ANOVA was planned to explore the five categorical variables, main effects, and dimensions and the relationship with the third grade reading proficiency as measured by PSSA assessments.

Research Question 2

It was hypothesized that the weeks of instruction will predict the proficiency rate in the area of mathematics in third grade on PSSA assessments, where mathematics proficiency would be positively correlated with the amount of instruction prior to the assessment administration. The variables involved with this research question included the weeks of instruction during the year of administration and mathematics proficiency. An average of the weeks of instruction for the two short instruction years as well as an average for the two long instruction years for each school district were calculated. The average for each variable and district was analyzed. A 5-way ANOVA was planned to determine the effect size and p-value coefficients of the variables in order to determine strength of the prediction between the variables. It was assumed that the dependent variable data used in the ANOVA was interval, that normality was present, equal variances were present, and the ancillary variable data were linear. The following steps were be taken in order to examine the appropriateness of these assumptions: review the data, use descriptive statistics in SPSS, look at a histogram, and examine pairwise comparisons within a scattergram. The effect sizes and p-value coefficients were examined to determine the strengths of the prediction once the assumptions have been checked.

A 5-way ANOVA was planned to examine differences in the outcome variables which were related to the predictor variables. It was assumed that the data used in the ANOVA were normally distributed with equal variances. The following steps were be taken in order to examine the appropriateness of these assumptions: review the data, use descriptive statistics in SPSS, and look at a histogram. It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in mathematics in third grade, where stronger associations would be present in school districts with greater resource availability. It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding mathematics proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. Additionally, it was hypothesized that school district interaction density would predict mathematics proficiency, where school districts that had lower student teacher ratios would have higher mathematics proficiency in third grade. Finally, it was hypothesized that school district proficiency status would predict mathematics proficiency, where school districts that had met AYP standards would have higher mathematics proficiency in third grade.

Together, a 5-way ANOVA was planned to explore the five categorical variables, main effects, and dimensions and the relationship with the third grade mathematics proficiency as measured by PSSA assessments. The 5-way ANOVA planned to have five between dimensions for analysis.

Research Question 3

It was hypothesized that associations would exist between the following latent variables: resources availability, population density, interaction density, and school district AYP status. The variables involved with this research question included resource availability, population density, interaction density, and school district AYP status to examine the associations. The planned analysis was Spearman's Rho. It was assumed that the data used were ordinal and the data was linear. The following steps were taken in order to examine the appropriateness of these assumptions: review the data, use descriptive statistics in SPSS, and look at a scattergram. Effect sizes and correlation coefficients were examined to determine the strengths of the associations once the assumptions were checked.

See Table 9, Table 10, and Table 11 for an outline of the research questions, corresponding hypotheses, variables, statistical procedure, assumptions, and assumption checks.

Table 9

Hypotheses, Variables, Analyses, Assumptions, and Assumption Check for the Research Question 1: "Do any of the Following Variables Predict the Proficiency Rate in the Area of Reading in Third Grade?"

Hypothesis	Variables	Statistical Analysis	Statistical Assumptions	Appropriateness of Assumptions
Weeks of instruction will predict the proficiency rate in the area of reading in third grade on PSSA assessments, where reading proficiency will be positively correlated with the amount of instruction prior to the assessment administration	Weeks of Instruction Reading Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances 4.Linearity	1.Review data 2.Use descriptive statistics in SPSS 3.Look at a histogram 4.Examine pairwise comparisons within a scattergram
An association will exist between district resource availability and school district proficiency percentages in reading in third grade, where stronger correlations will be present in school districts with greater resource availability	Resource Availability Reading Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram

Hypothesis	Variables	Statistical Analysis	Statistical Assumptions	Appropriateness of Assumptions
An association will exist between district population density and school district proficiency percentages regarding reading proficiency in third grade, where stronger correlations will be present in suburban school district in comparison to rural and urban school districts	Population Density Reading Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram
School district interaction density will predict reading proficiency, where school districts that have lower student teacher ratios will have higher reading proficiency in third grade	Interaction Density Reading Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram
School district AYP status will predict reading proficiency, where school districts that have met AYP standards will have higher reading proficiency in third grade	Proficiency Status Reading Proficiency	ANOVA	1.Ordinal data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram

Table 10

Hypotheses, Variables, Analyses, Assumptions, and Assumption Check for the Research Question 2: "Do any of the Following Variables Predict the Proficiency Rate in the Area of Mathematics in Third Grade?"

Hypothesis	Variables	Statistical Analysis	Statistical Assumptions	Appropriateness of Assumptions
Weeks of instruction will predict the proficiency rate in the area of mathematics in third grade on PSSA assessments, where mathematics proficiency will be positively correlated with the amount of instruction prior to the assessment administration	Weeks of Instruction Mathematics Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances 4.Linearity	1.Review data 2.Use descriptive statistics in SPSS 3.Look at a histogram 4.Examine pairwise comparisons within a scattergram
An association will exist between district resource availability and school district proficiency percentages in mathematics in third grade, where stronger correlations will be present in school districts with greater resource availability	Resource Availability Mathematics Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram

Hypothesis	Variables	Statistical Analysis	Statistical Assumptions	Appropriateness of Assumptions
An association will exist between district population density and school district proficiency percentages regarding mathematics proficiency in third grade, where stronger correlations will be present in suburban school district in comparison to rural and urban school districts	Population Density Mathematics Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram
School district interaction density will predict mathematics proficiency, where school districts that have lower student teacher ratios will have higher mathematics proficiency in third grade	Interaction Density Mathematics Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram
School district AYP status will predict mathematics proficiency, where school districts that have met AYP standards will have higher mathematics proficiency in third grade	Proficiency Status Mathematics Proficiency	ANOVA	1.I/R/A data 2.Normality 3.Equal variances	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at a histogram

Table 11

Hypotheses, Variables, Analyses, Assumptions, and Assumption Check for the Research Question 3: "Do any Associations Exist Among the Latent Variables?"

Hypothesis	Variables	Statistical Analysis	Statistical Assumptions	Appropriateness of Assumptions
It is hypothesized that associations will exist between the following latent variables: resources availability, population density, interaction density, and school district AYP status	Resources Availability Population Density Interaction Density Proficiency Status	Spearman's Rho	1.I/R/A data 2.Linearity	1.Review the data 2.Use descriptive statistics in SPSS 3.Look at scattergram

Summary

The purpose of this study was to examine the varying instructional time across four academic school years and the resulting school district third grade proficiency rates in reading and mathematics on PSSA assessments. The year of administrations varied in the month in which the PSSA was administered (March or April). A 5-way ANOVA was planned to be the primary statistical analysis utilized in order to determine if a relationship existed between the weeks of instruction prior to PSSA administration as well as resource availability, population density, interaction density, and AYP status, and the resulting relationships with reading and mathematics proficiency in third grade. Spearman's Rho was also planned to examine the relationships between the latent variables of the study. Assumptions of analysis procedures were checked to ensure that an accurate statistical analysis were utilized.

CHAPTER FOUR

RESULTS

The purpose of this study was to examine the varying instructional time across four academic school years and the resulting school district third grade proficiency rates in reading and mathematics on the Pennsylvania System of School Assessment (PSSA). Specifically, this research study set out to determine the following:

(1) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area reading in third grade?

(2) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area mathematics in third grade?

(3) Do any associations exist among the following variables: resources availability, population density, interaction density, and school district annual yearly progress status?

The following sections will review the results for this study. They will include a description of study complications, computer programs, and analysis of research findings. The results indicated a significant differences between the long and short instructional years regarding reading and math proficiency when looking at the third grade PSSA. Additionally, the latent variables resource availability as measured by aid ratio market value/personal income, population density, and school district proficiency status were also found to be significant predictors of reading proficiency on the third grade PSSA. The latent variables of resource availability as measured by aid ratio market value/personal income and school district proficiency status were also found to be significant predictors of math proficiency on the third grade PSSA. Small positive and negative correlations were also found between variable predictors.

Complications

There were complications that arose while attempting to run the data analysis for Research Questions 1 and 2 using the proposed 5-way Analysis of Variance (ANOVA). These included too many empty cells in the 5-way ANOVA, assumption violations impacting validity, and the analysis not running for Research Question 2. Several efforts were made to collapse the cells in a meaningful way to eliminate the empty cells. The 5-way ANOVA for the reading proficiency was run using the following variables:

(1) Weeks of Instruction – 2 Levels (short year, long year)

(2) Resource Availability – 3 Levels for Cost per Pupil Expenditure (<$12,700, $12,700-$14,800, and >$14,800)

(3) Population Density – 3 Levels (City/Suburb, Town, Rural)

(4) Interaction Density – 3 Level for Student/Teacher Ratio (<14, 14-15.4, >15.4)

(5) Proficiency Status – 2 Levels (made Annual Yearly Progress (AYP) both years, did not make AYP at least one year)

The total expected cell count for the 5-way ANOVA using these levels was 108. This included frequencies for all possible cells include empty cells with a count of 0. Using this model, there were 14 cells with a count of 0. Therefore, 13% of expected cells were empty. Additional efforts were made to collapse the cells in a meaningful way to eliminate the empty cells. Further inspection determined that most of the empty cells were due to a very small number of short years when AYP was not achieved in at least one of the two years examined. Forty-four of the 499 school districts were found to not have made AYP in at least one of the short years, or approximately 8.8%.

Further, because the proficiency status variable was already two levels, the data was unable to be collapsed.

The assumptions when running the 5-way ANOVA included the following: interval data, normality, and/or equal variances. The appropriateness of the assumptions were checked by reviewing the data, using descriptive statistics, and looking at a histogram. The assumption checks indicated that the model assumptions of normality and equal variances were violated in the 5-way ANOVA analysis for reading proficiency.

The 5-way ANOVA model using the same levels for reading proficiency was used to attempt to run the analysis for math proficiency. However, the 5-way ANOVA analysis for math proficiency was inappropriate because of the number of empty cells. This resulted in analysis error and producing no statistics. As a result of the complications, it was concluded that the proposed 5-way ANOVA was an inappropriate fit for the data analysis of Research Questions 1 and 2. An alternate analysis using 1-way ANOVA and nonparametric Kruskal-Wallis tests for data analysis was used instead to determine if the ancillary variables predicted reading and math proficiency on PSSA assessments. To adjust for family-wise error rates, the alpha level for comparison was adjusted from .05 to .008 to determine the significance of the predictions. This adjustment was based upon the Bonferroni correction procedure, where the desired significance level was divided by the number of study hypotheses for the research question (Dunn 1959; Dunn 1961).

Computer Programs

The data obtained for this study were analyzed using the Statistical Passage for the Social Sciences (SPSS) and Statistical Analysis System (SAS) software programs. SAS is statistical software utilized for advanced analytics, multivariate analysis, and predictive analytics for research purposes (SAS Institute Inc., 2016). SAS software was used to calculate the 1-way ANOVA, nonparametric Kruskal-Wallis tests, Spearman’s Rho, Pearson correlations and Kendall's Tau B for the purpose of this study. SPSS is statistical software also used to perform complex data analyses and manipulations (IBM Analytics, 2016). SPSS Statistics 23 software was utilized to calculate the descriptive statistics for the ancillary and outcome variables for the purpose of this study.

Analysis

In order to examine the relationships that each variable had with the outcomes, 1-way ANOVA and nonparametric Kruskal-Wallis tests were applied using SAS software. 1-way ANOVA and nonparametric Kruskal-Wallis tests were used for data analysis for Research Questions 1 and 2 for each ancillary variable because of the normality assumption being violated for the outcome variables. This was due to school district proficiency scores in both reading and math being skewed towards higher levels of proficiency. For this purpose, both 1-way ANOVA and nonparametric Kruskal-Wallis tests were used for data analysis to examine the effect of distribution shapes. To adjust for family-wise error rates, the alpha level for comparison was adjusted from .05 to .008 to determine the significance of the predictions. This adjustment was based upon the Bonferroni correction procedure, where the desired significance level was divided by the number of study hypotheses for the research question (Dunn 1959; Dunn 1961). Spearman's Rho, Pearson parametric correlations, and Kendall's Tau B nonparametric correlation approaches were also applied using SAS software to examine the relationships between latent variables for Research Question 3. The population for analysis was 499 of the 500 Pennsylvania school districts. One school district was excluded from analysis due to not having available data for many of the ancillary variables as well as the outcome variables.

Research Question 1

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to explore the five categorical variables, main effects, and relationships with third grade reading proficiency as measured by PSSA assessments. The ANOVA had five between dimensions for analysis. To adjust for family-wise error rates, the alpha level for comparison was adjusted from .05 to .008 to determine the significance of the predictions. This adjustment was based upon the Bonferroni correction procedure, where the desired significance level was divided by the number of study hypotheses for the research question (Dunn 1959; Dunn 1961).

It was hypothesized that the weeks of instruction would predict the proficiency rate in the area of reading in third grade on PSSA assessments, where reading proficiency would be positively correlated with the amount of instruction prior to the assessment administration. The variables involved with this research question included the weeks of instruction during the year of administration and reading proficiency. An average of the weeks of instruction for the two years in which the PSSA assessments were conducted in March (herein defined as short instruction years), as well as an average for the two years the PSSA assessments were conducted in April (herein defined as long instruction years) for each school district were calculated. The average for each variable and district was the data analyzed. For 2010-2011 and 2011-2012 (short years), mean weeks of instruction of 28.01 and 27.83 were obtained. For 2009-2010 and 2012-2013 (long years), mean weeks of instruction of 31.51 and 31.87 were obtained.

Descriptive statistics for reading proficiency are displayed in Table 12. For 2010-2011 and 2011-2012 (short years), mean reading proficiency rates of 79.82% and 78.45% were obtained. For 2009-2010 and 2012-2013 (long years), mean reading proficiency rates of 78.43% and 77.33% were obtained. Standard deviations for all four years ranged from 9.85 to 10.79. The normality of the data was assessed first through visual inspection of the frequency distributions. Each of the years of instruction frequency distributions approximated a normal curve upon inspection of a histogram.

Skewness and kurtosis statistics were also analyzed to determine normality. Values for skewness ranged from -1.20 to 1.54. Values for kurtosis ranged from 4.67 to 2.58. This indicated that the normality assumption was violated for the reading proficiency outcome variable. For this reason, it was decided to also analyze the data using the nonparametric Kruskal-Wallis test in addition to the 1-way ANOVA in order to examine the effect of distribution shapes.

Table 12

Descriptive Statistics for Reading Proficiency on Third Grade PSSA

Year	Mean	SD	Range	Skewness	Kurtosis
2009-2010-L	78.43	10.11	13.30-98.50	-1.48	4.91
2010-2011-S	79.82	9.97	20.50-100.00	-1.54	4.67
2011-2012-S	78.45	9.85	28.20-96.30	-1.22	2.70
2012-2013-L	77.33	10.79	26.80-97.90	-1.20	2.58

Note. n=499

Descriptive statistics were also examined for the weeks of instruction ancillary variable. Weeks of instruction were defined as the weeks between the beginning of the student start date and the testing window for PSSA testing for the corresponding school year. The sample size for weeks of instruction ranged from 484 in 2009-2010 to 499 in 2010-2011. This varied due to a minimal number of school district failing to report student start dates to the state department of education. In those instances, the start date was reported as the beginning of the fiscal year (July 1). Those dates were eliminated as outliers for analysis purposes. For 2010-2011 and 2011-2012 (short years), mean weeks of instruction of 28.01 and 27.83 were obtained. For 2009-2010 and 2012-2013 (long years), mean weeks of instruction of 31.51 and 31.87 were obtained. Standard deviations for all four years ranged from .57 to .99. The normality of the data was assessed through visual inspection of the frequency distributions. Each of the years of instruction frequency distributions approximated a normal curve upon inspection of a histogram. See Table 13.

Table 13

Descriptive Statistics for Weeks of Instruction Prior to Third Grade PSSA

Year	Mean	SD	Range
2009-2010-L	31.51	.72	30.00-35.29
2010-2011-S	28.01	.70	25.57-36.57
2011-2012-S	27.83	.57	25.57-30.85
2012-2013-L	31.87	.99	29.00-40.14

Note. n_a=484 n_b=499 n_c=493 n_d=494

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to calculate the effect size and p-value coefficients of the weeks of instruction variable to determine the strength of the prediction of reading proficiency and to examine the effect of distribution shapes. Mean ranks for reading proficiency ranged from 77.88 for long years to 79.13 for short years.   P-value coefficients of <.0001 for the 1-way ANOVA and .0204 for the nonparametric Kruskal-Wallis test were obtained. These indicated a significant difference between the weeks of instruction for the reading proficiency rates on the third grade PSSA on the 1-way ANOVA. Proficiency rates were converted to z-values for data analysis purposes. See Table 14.

The results the 1-way ANOVA indicated a significant difference between the long and short instructional years regarding reading proficiency on the third grade PSSA. However, the hypothesis of higher proficiency rates during longer instructional years was rejected. This was because mean proficiency rates were higher during years with less of weeks of instruction prior to the administration of the PSSA in reading for third grade. A significant difference was not found on the nonparametric Kruskal-Wallis test with an adjusted alpha level of .008. This was due to the data distribution shape.

Table 14

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Reading Proficiency by Weeks of Instruction

DESCRIPTIVE STATISTICS

VARIABLE	n	Mean	S.D.	Range
Short Years	499	79.13	9.37	24.35-96.90
Long Years	499	77.88	9.73	21.80-97.20

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
Short Years	499	0.06	0.97	-5.65-1.92
Long Years	499	-0.06	1.01	-5.92-1.95

ANALYSIS OF VARIANCE

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	Cohen's *d*	Chi-Square	df	p	n^2
Years	1	36.30	<.0001**	.4047	5.37	1	.0204	.0107

Note. **Indicates significant difference at .008

Additional 1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to examine differences in the outcome variables which were related to the predictor variables. It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in reading in third grade, where stronger associations would be present in school districts with greater resource availability. It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding reading proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. Additionally, it was hypothesized that school district interaction density would predict reading proficiency, where school districts that had lower student teacher ratios would have higher reading proficiency in third grade. The variables involved with this research question included school district interaction density and reading proficiency. Finally, it was hypothesized that school district AYP status would predict reading proficiency, where school districts that had met AYP standards would have higher reading proficiency in third grade.

Resource availability was examined by two different latent variables for the purpose of this study: per student expenditure and school district aid ratio. For student expenditure, the total expenditures per average daily membership for corresponding school years was utilized. Mean student expenditures per school district ranged from $13,692.34 in 2009-2010 to $14,595.86 in 2012-2013. Standard deviations for all four years ranged from $2485.73 in 2009-2010 to $2883.26 in 2012-2013. The normality of the data was assessed through visual inspection of the frequency distributions. Each year of student expenditure frequency distributions approximated a normal curve upon inspection of a histogram. See Table 15.

Table 15

Descriptive Statistics for Student Expenditure for Average Daily Membership

Year	Mean	SD	Range
2009-2010	12692.34	2485.73	9578.76-26570.76
2010-2011	14068.69	2639.41	9974.28-29874.05
2011-2012	14120.00	2830.01	9529.75-30728.60
2012-2013	14595.86	2883.26	9803.01-28418.82

Note. n=499

For aid ratio, the market value/personal income (MV/PI) aid ratio for each school district for corresponding school years was utilized. Mean aid ratios were approximately .55 for each school year analyzed. Standard deviations for all four years were approximately .16. The normality of the data was assessed through visual inspection of the frequency distributions. Each year of student expenditure frequency distributions approximated a normal curve upon inspection of a histogram. See Table 16.

Table 16

Descriptive Statistics for Market Value/Personal Income Aid Ratio

Year	Mean	SD	Range
2009-2010	.55	.16	.15-.88
2010-2011	.55	.16	.15-.88
2011-2012	.55	.16	.15-.88
2012-2013	.55	.16	.15-.89

Note. n=499

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to calculate the effect size and p-value coefficients of the resource availability as measured by student expenditure as well as school district aid ratio to determine the strength of the prediction of reading proficiency and to examine the effect of distribution shapes. Student expenditure was categorized into four categories for analysis purposes: less than $12,400, greater than $12,400 to $13,700, greater than $13,700 to $15,500, and greater than $15,500. These cut points were established in order to have close to equal distribution between group sizes. P-value coefficients of .5830 for the 1-way ANOVA and .0788 for the nonparametric Kruskal-Wallis test were obtained. These did not indicate a significant difference between resource availability as measured by student expenditure for the reading proficiency rates on the third grade PSSA. Proficiency rates were converted to z-values for data analysis purposes. See Table 17.

It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in reading in third grade, where stronger associations would be present in school districts with greater resource availability. Resource availability as measured by student expenditure did not indicate a significant difference for reading proficiency in third grade on the PSSA.

Table 17

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Reading Proficiency by Student Expenditure per Average Daily Membership

DESCRIPTIVE STATISTICS				
VARIABLE	n	Mean	S.D.	Range
<$12,400	128	79.31	7.08	51.00-94.85
>$12,400-$13,700	123	77.75	7.10	54.55-97.05
>$13,700-$15,500	122	78.71	8.84	48.10-92.80
>$15,500	126	78.22	12.83	23.07-95.35
VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
<$12,400	128	0.08	0.76	-2.96-1.76
>$12,400-$13,700	123	-0.08	0.76	-2.58-2.00
>$13,700-$15,500	122	0.02	0.95	-3.28-1.54
>$15,500	126	-0.03	1.38	-5.98-1.81

ANALYSIS OF VARIANCE

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Student Expenditure	3	0.65	.5830	.0039	6.79	3	.0788	.0136

Market value/personal income aid ratio was categorized into four categories for analysis purposes: less than .46, greater than .46-.59, greater than .59-.68, and greater than .68. These cut points were established in order to have close to equal distribution between group sizes. P-value coefficients of <.0001 for the 1-way ANOVA and <.0001 for the nonparametric Kruskal-Wallis test were obtained. These indicated a significant difference between resource availability as measured by school district market value/personal income aid ratio for the reading proficiency rates on the third grade PSSA. Proficiency rates were converted to z-values for data analysis purposes. See Table 18.

It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in reading in third grade, where stronger associations would be present in school districts with greater resource availability. Resource availability as measured by market value/personal income aid ratio indicated a significant difference for reading proficiency in third grade on the PSSA on both the 1-way ANOVA and nonparametric Kruskal-Wallis test. This indicated that school districts with lower aid ratios were more likely to have higher reading proficiency rates in third grade on the PSSA.

Table 18

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Reading Proficiency by Market Value/Personal Income Aid Ratio

DESCRIPTIVE STATISTICS

VARIABLE	n	Mean	S.D.	Range
<.46	130	84.56	6.69	59.20-95.35
>.46-.59	121	80.17	5.68	61.05-97.05
>.59-.68	125	77.36	7.09	35.75-89.87
>.68	123	71.63	11.37	23.07-92.92

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
<.46	130	0.65	0.72	-2.08-1.81
>.46-.59	121	0.17	0.61	-1.88-2.00
>.59-.68	125	-0.12	0.76	-4.61-1.22
>.68	123	-0.74	1.22	-5.98-1.55

ANALYSIS OF VARIANCE

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Aid Ratio	3	57.68	<.0001**	.2590	145.53	3	<.0001**	.2922

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SCHEFFE	Estimate	Std. Error	df	t	P>|t|	Adj. P
<.46 vs. >.46-.59	.4736	.1091	495	4.34	<.0001	.0003
<.46 vs. >.59-.68	.7763	.1082	495	7.18	<.0001	<.0001
<.46 vs. >.68	1.3953	.1086	495	12.85	<.0001	<.0001
>.46-.59 vs. >.59-.68	.3027	.1101	495	2.75	.0062	.0574
>.46-.59 vs. >.68	.9216	.1106	495	8.53	<.0001	<.0001
>.59-.68 vs. >.68	.6190	.1097	495	5.64	<.0001	<.0001

MANN-WHITNEY U	Class	Mean Rank	Sum of Ranks	Cases	z	p
<.46 vs. >.46-.59	1	153.37	19939.0	130	-6.19	<.0001
	2	96.58	11687.0	121		
<.46 vs. >.59-.68	3	88.60	11075.5	125	-8.36	<.0001
	1	165.88	21564.5	130		
<.46 vs. >.68	4	78.41	9645.5	123	-10.27	<.0001
	1	172.96	22485.5	130		
>.46-.59 vs. >.59-.68	3	109.66	13707.5	125	3.09	.0022
	2	137.79	16673.5	121		
>.46-.59 vs. >.68	4	91.05	11200.0	123	7.01	<.0001
	2	154.46	18690.0	121		
>.59-.68 vs. >.68	4	103.77	12764.5	123	-4.51	<.0001
	3	144.89	18111.5	125		

Note. **Indicates significant difference at .008

Population density was examined by reporting the urban-centric code for each school district for corresponding years in the study. The urban-centric code was reported for 498 school districts. One school district did not have an urban-centric code assigned and was not utilized as part of the analysis for population density. The urban-centric code for each school district was consistent between school years examined. School districts fell into 1 of 12 urban-centric code categories: 1-City:Small, 2-City:Midsize, 3-City:Large, 4-Suburb:Small, 5-Suburb:Mid-size, 6-Suburb:Large, 7-Town:Fringe, 8-Town:Distant, 9-Town:Remote, 10-Rural:Fringe, 11-Rural:Distant, and 12-Rural:Remote. Frequencies ranged from n=2 for both City: Midsize and City: Large to n=166 for Suburb: Large. Therefore, the average school district analyzed had an urban-centric code of Suburb: Large. See Table 19. Because the number of school districts had such a diverse range per urban-centric code category, these categories were condensed for analysis purposes.

Population density as measured by urban-centric code was condensed into three categories for analysis purposes: City-Suburb, Town, and Rural. These cut points were established in order to have close to equal distribution between population density group sizes. P-value coefficients of .6857 for the 1-way ANOVA and .0024 for the nonparametric Kruskal-Wallis test were obtained. This indicated a significant difference for population density as measured by urban-centric and the reading proficiency rates on the third grade PSSA on the nonparametric Kruskal-Wallis test, but not on the 1-way ANOVA. Proficiency rates were converted to z-values for data analysis purposes. See Table 20.

Table 19

Frequency Distribution for Population Density

Urban-Centric	Frequency	Percent
City: Small	13	2.6%
City: Midsize	2	.4%
City: Large	2	.4%
Suburb: Small	20	4.0%
Suburb: Mid-size	21	4.2%
Suburb: Large	166	33.3%
Town: Fringe	64	12.8%
Town: Distant	26	5.2%
Town: Remote	10	2.0%
Rural: Fringe	77	12.4%
Rural: Distant	85	17.0%
Rural: Remote	12	2.4%

Note. n=498

It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding reading proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. A significant difference was not found between population density for reading proficiency on the 1-way ANOVA. However, a significant difference was found between population density for reading proficiency as measured by the nonparametric Kruskal-Wallis test for the adjusted alpha level. This was because the distribution shape had an effect on the 1-way ANOVA. This indicated that school districts classified as City-Suburb were more likely to have higher proficiency rates in reading compared to those classified as Town or Rural for analysis purposes using the Kruskal-Wallis.

Table 20

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Reading Proficiency by Population Density

DESCRIPTIVE STATISTICS -

VARIABLE	n	Mean	S.D.	Range
City-Suburb	224	78.59	12.25	23.07-95.35
Town	100	77.80	5.75	63.30-89.60
Rural	174	78.79	5.84	63.67-97.05

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
City-Suburb	224	0.09	1.32	-5.98-1.81
Town	100	-0.07	0.62	-1.64-1.19
Rural	174	0.03	0.63	-1.60-2.00

ANALYSIS OF VARIANCE -

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Urban-Centric Code	2	.38	.6857	.0015	12.04	2	.0024**	.0242

POST HOC -

MANN-WHITNEY U	Class	Mean Rank	Sum of Ranks	Cases	z	p
City-Suburb vs. Town	2	138.71	13871.5	100	-3.05	.0025
	1	173.11	38778.5	224		
City-Suburb vs. Rural	3	182.47	31750.0	174	-2.60	.0096
	1	212.72	47651.0	224		
Town vs. Rural	3	141.18	24566.0	174	-1.01	.3113
	2	131.09	13109.0	100		

Note. **Indicates significant difference at .008

Interaction density was examined by calculating the student teacher ratio for school district for corresponding years in the study. Student teacher ratio was calculated by the average daily membership for each school district divided by the number of teachers employed for each school district. Mean student teacher ratios ranged from 14.47 in 2009-2010 to 15.04 in 2012-2013. Standard deviations for all four years ranged from 1.80 in 2009-2010 to 2.51 in 2012-2013. The normality of the data was assessed through visual inspection of the frequency distributions. Each year of interaction density frequency distributions approximated a normal curve upon inspection of a histogram. See Table 21.

Table 21

Descriptive Statistics for Interaction Density

Year	Mean	SD	Range
2009-2010	14.47	1.80	8.06-30.35
2010-2011	14.46	1.81	7.59-26.16
2011-2012	14.98	2.23	7.71-41.03
2012-2013	15.04	2.51	6.97-46.70

Note. n=499

Interaction density as measured by student teacher ratio was categorized into four categories for analysis purposes: less than 13.6, greater than 13.6 to 14.7, greater than 14.7 to 15.7, and greater than 15.7. These cut points were established in order to have close to equal distribution between group sizes. P-value coefficients of .3132 for the 1-way ANOVA and .4224 for the nonparametric Kruskal-Wallis test were obtained. These did not indicate a significant difference between interaction density groups as measured by student teacher ratio for the reading proficiency rates on the third grade PSSA. Proficiency rates were converted to z-values for data analysis purposes. See Table 22.

It was hypothesized that school district interaction density would predict reading proficiency, where school districts that had lower student teacher ratios would have higher reading proficiency in third grade. A significant difference was not found between school district interaction density for reading proficiency on the third grade PSSA. This hypothesis was therefore rejected.

Table 22

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Reading Proficiency by Interaction Density

DESCRIPTIVE STATISTICS -

VARIABLE	n	Mean	S.D.	Range
<13.6	127	79.42	8.85	35.75-93.37
>13.6-14.7	124	77.56	8.85	40.15-95.35
>14.7-15.7	127	79.09	7.18	54.55-92.40
>15.7	121	77.90	11.69	23.07-97.05

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
<13.6	127	0.09	0.95	-4.61-1.60
>13.6-14.7	124	-0.10	0.95	-4.13-1.81
>14.7-15.7	127	0.06	0.77	-2.58-1.49
>15.7	121	-0.06	1.26	-5.98-2.00

ANALYSIS OF VARIANCE -

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Student/Teacher Ratio	3	1.19	.3132	.0071	2.80	3	.4224	.0056

Proficiency status was examined by school district annual yearly progress (AYP) status for corresponding years in the study. School districts fell into 1 of 7 proficiency categories: 1-Made AYP, 2-Warning, 3-School Improvement I, 4-School Improvement II, 5-Making Progress, 6-Corrective Action I, and 7-Corrective Action II. Proficiency status for 499 school districts was reported for 2010, 2011, and 2010. Proficiency status for 498 school districts was reported for 2009. See Table 23. The vast majority of school districts had Made AYP proficiency status going into the third grade PSSA for the at least one of the years analyzed for the study. Therefore, the average school district had Made AYP proficiency status. As a result, the categories were condensed for analysis purposes.

Table 23

Frequency Distribution for Proficiency Status

Year	Proficiency Status	Frequency	Percent
2009	Made AYP	466	93.4%
	Warning	12	2.4%
	School Improvement I	1	0.2%
	School Improvement II	1	0.2%
	Making Progress	6	1.2%
	Corrective Action I	1	0.2%
	Corrective Action II	11	2.2%
2010	Made AYP	473	94.8%
	Warning	8	1.5%
	School Improvement I	2	0.4%
	School Improvement II	1	0.2%
	Making Progress	5	1.0%
	Corrective Action I	0	0%
	Corrective Action II	10	2.0%
2011	Made AYP	463	92.8%
	Warning	18	3.6%
	School Improvement I	3	0.6%
	School Improvement II	0	0%
	Making Progress	4	0.8%
	Corrective Action I	0	0%
	Corrective Action II	11	2.2%
2012	Made AYP	305	61.1%
	Warning	164	32.9%
	School Improvement I	12	2.4%
	School Improvement II	5	0.2%
	Making Progress	6	1.0%
	Corrective Action I	1	0.2%
	Corrective Action II	12	2.4%

Note. n_a=498 n_b=499 n_c=499 n_d=499

Proficiency status as measured by AYP status was condensed into five categories for analysis purposes: Made AYP all 4 years, Made AYP 3 out of 4 years, Made AYP 2 out of 4 years, Made AYP 1 out of 4 years, or Did Not Make AYP in any of the 4 years. P-value coefficients of <.0001 for the 1-way ANOVA and <.0001 for the nonparametric Kruskal-Wallis test were obtained. This indicated a significant difference between proficiency status as measured by AYP status for the reading proficiency rates on the third grade PSSA. See Table 24.

Table 24

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Reading Proficiency by Proficiency Status

DESCRIPTIVE STATISTICS

VARIABLE	n	Mean	S.D.	Range
Made AYP 4 Years	295	81.67	6.28	64.52-97.05
Made AYP 3/4 Years	159	77.19	7.68	39.25-90.30
Made AYP 2/4 Years	21	70.71	5.84	60.10-81.27
Made AYP 1/4 Years	8	59.56	17.02	23.07-73.55
Did Not Make AYP	16	52.91	9.21	35.75-71.77

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
Made AYP 4 Years	295	0.34	0.67	-1.50-2.00
Made AYP 3/4 Years	159	-0.14	0.82	-4.23-1.27
Made AYP 2/4 Years	21	-0.84	0.63	-1.98-0.29
Made AYP 1/4 Years	8	-2.04	1.83	-5.98—(0.53)
Did Not Make AYP	16	-2.75	0.99	-4.61-(0.72)

ANALYSIS OF VARIANCE

Source of Variation	PARAMETRIC df	F	p	n^2	KRUSKAL-WALLIS Chi-Square	df	p	n^2
AYP Status	4	88.21	<.0001**	.4166	121.74	4	<.0001**	.2444

POST HOC

VARIABLE	KEY
Made AYP 4 years	0
Made AYP 3/4 years	1
Made AYP 2/4 years	2
Made AYP 1/4 years	3
Did Not Make AYP	4

SCHEFFE	Estimate	Std. Error	df	t	P>|t|	Adj. P
0 vs. 1	.4825	.0754	494	6.40	<.0001	<.0001
0 vs. 2	1.1820	.1732	494	6.82	<.0001	<.0001
0 vs. 3	2.3852	.2748	494	8.68	<.0001	<.0001
0 vs. 4	3.0993	.1968	494	15.75	<.0001	<.0001
1 vs. 2	.6995	.1780	494	3.93	<.0001	.0042
1 vs. 3	1.9027	.2779	494	6.85	<.0001	<.0001
1 vs. 4	2.6168	.2011	494	13.01	<.0001	<.0001
2 vs. 3	1.2032	.0186	494	3.78	.0002	.0070
2 vs. 4	1.9173	.2545	494	7.53	<.0001	<.0001
3 vs. 4	.7141	.3321	494	2.15	.0320	.3294

MANN-WHITNEY U	Class	Mean Rank	Sum of Ranks	Cases	z	p
0 vs. 1	1	176.91	28130.0	159	-6.03	<.0001
	0	254.76	75155.0	295		
0 vs. 2	2	41.04	862.0	21	-6.09	<.0001
	0	166.86	49224.0	295		
0 vs. 3	0	155.73	45942.0	295	-4.50	<.0001
	3	14.25	114.0	8		
0 vs. 4	4	9.59	153.5	16	-6.68	<.0001
	0	163.94	48362.5	295		
1 vs. 2	1	96.32	15315.0	159	-4.12	<.0001
	2	46.42	975.0	21		
1 vs. 3	1	87.18	13863.0	159	-3.79	.0002
	3	20.62	165.0	8		
1 vs. 4	1	95.62	15204.0	159	-6.27	<.0001
	4	12.25	196.0	16		
2 vs. 3	2	16.85	354.0	21	-1.87	.0707
	3	10.12	81.0	8		
2 vs. 4	2	26.38	554.0	21	-4.73	<.0001
	4	9.31	149.0	16		
3 vs. 4	4	10.81	173.0	16	1.62	.1183
	3	15.87	127.0	8		

Note. **Indicates significant difference at .008

It was hypothesized that school district AYP status would predict reading proficiency, where school districts that had met AYP standards would have higher reading proficiency in third grade. Proficiency status as measured by AYP status indicated a significant difference for reading proficiency in third grade on the PSSA. This indicated that school districts that had made AYP the previous school year were likely to have higher proficiency rates in reading the following year on the third grade PSSA.

Research Question 2

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to explore the five categorical variables, main effects, and relationships with third grade math proficiency as measured by PSSA assessments. The ANOVA had five between dimensions for analysis. To adjust for family-wise error rates, the alpha level for comparison was adjusted from .05 to .008 to determine the significance of the predictions. This adjustment was based upon the Bonferroni correction procedure, where the desired significance level was divided by the number of study hypotheses for the research question (Dunn 1959; Dunn 1961).

It was hypothesized that the weeks of instruction would predict the proficiency rate in the area of math in third grade on PSSA assessments, where math proficiency would be positively correlated with the amount of instruction prior to the assessment administration. The variables involved with this research question included the weeks of instruction during the year of administration and math proficiency. An average of the weeks of instruction for the two short instruction years, as well as an average for the two long instruction years for each school district were calculated. For 2010-2011 and 2011-2012 (short years), mean weeks of instruction of 28.01 and 27.83 were obtained. For 2009-2010 and 2012-2013 (long years), mean weeks of instruction of 31.51 and 31.87 were obtained. The average for each variable and district was the data analyzed.

Descriptive statistics for math proficiency are displayed in Table 25. For 2010-2011 and 2011-2012 (short years), mean math proficiency rates of 86.22% and 84.68% were obtained. For 2009-2010 and 2012-2013 (long years), mean math proficiency rates of 87.67% and 81.47% were obtained. Standard deviations for all four years ranged from 7.65 to 10.48. The normality of the data was assessed first through visual inspection of the frequency distributions. Each of the years of instruction frequency distributions approximated a normal curve upon inspection of a histogram. Skewness and kurtosis statistics were also analyzed to determine normality. Values for skewness ranged from -2.01 to -1.29. Values for kurtosis ranged from 2.75 to 7.39. This indicated that the normality assumption was violated for the math proficiency outcome variable. For this reason, it was decided to also analyze the data using the nonparametric Kruskal-Wallis test in addition to the 1-way ANOVA in order to examine the effect of distribution shapes.

Table 25

Descriptive Statistics for Math Proficiency on Third Grade PSSA

Year	Mean	SD	Range	Skewness	Kurtosis
2009-2010-L	87.67	7.65	49.90-100.00	-1.46	3.58
2010-2011-S	86.22	8.76	25.60-100.00	-2.01	7.39
2011-2012-S	84.68	8.90	40.70-100.00	-1.46	3.61
2012-2013-L	81.47	10.48	24.30-98.70	-1.29	2.75

Note. n=499

Descriptive statistics were also examined for the weeks of instruction ancillary variable. Weeks of instruction were defined as the weeks between the beginning of the student start date and the testing window for PSSA testing for the corresponding school year. The sample size for weeks of instruction ranged from 484 in 2009-2010 to 499 in 2010-2011. This varied due to a minimal number of school district failing to report student start dates to the state department of education. In those instances, the start date was reported as the beginning of the fiscal year (July 1). Those dates were eliminated as outliers for analysis purposes. For 2010-2011 and 2011-2012 (short years), mean weeks of instruction of 28.01 and 27.83 were obtained. For 2009-2010 and 2012-2013 (long years), mean weeks of instruction of 31.51 and 31.87 were obtained. Standard deviations for all four years ranged from .57 to .99. The normality of the data was assessed through visual inspection of the frequency distributions. Each of the years of instruction frequency distributions approximated a normal curve upon inspection of a histogram. See Table 13.

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to calculate the effect size and p-value coefficients of the weeks of instruction variable to determine the strength of the prediction of math proficiency and to examine the effect of distribution shapes. Mean ranks for math proficiency ranged from 84.57% for long years to 85.45% for short years. P-value coefficients of <.0001 for the 1-way ANOVA and .0389 for the nonparametric Kruskal-Wallis test were obtained. These indicated a significant difference between the weeks of instruction for the math proficiency rates on the third grade PSSA on the 1-way ANOVA. Proficiency rates were converted to z-values for data analysis purposes. See Table 26.

Table 26

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Math Proficiency by Weeks of Instruction

DESCRIPTIVE STATISTICS

VARIABLE	n	Mean	S.D.	Range
Short Years	499	85.45	8.25	33.15-100
Long Years	499	84.57	8.30	36.60-98.60

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
Short Years	499	0.05	0.99	-6.25-1.80
Long Years	499	-0.05	1.00	-5.83-1.63

ANALYSIS OF VARIANCE

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	Cohen's *d*	Chi-Square	df	p	n^2
Years	1	23.49	<.0001**	.3649	4.26	1	.0389	.0085

Note. **Indicates significant difference at .008

The results the 1-way ANOVA indicated a significant difference between the long and short instructional years regarding math proficiency on the third grade PSSA. However, the hypothesis of higher proficiency rates during longer instructional years was rejected. This was because mean proficiency rates were higher during years with less of weeks of instruction prior to the administration of the PSSA in math for third grade. A significant difference was not found on the nonparametric Kruskal-Wallis test with an adjusted alpha level of .008. This was due to the data distribution shape.

Additional 1-way ANOVA and nonparametric Kruskal-Wallis tests were also utilized to examine differences in the outcome variables which were related to the predictor variables. It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in math in third grade, where stronger associations would be present in school districts with greater resource availability. It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding math proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. Additionally, it was hypothesized that school district interaction density would predict math proficiency, where school districts that had lower student teacher ratios would have higher math proficiency in third grade. The variables involved with this research question included school district interaction density and math proficiency. Finally, it was hypothesized that school district AYP status would predict math proficiency, where school districts that had met AYP standards would have higher math proficiency in third grade.

Resource availability was examined by two different latent variables for the purpose of this study: per student expenditure and school district aid ratio. For student expenditure, the total expenditures per average daily membership for corresponding school years was utilized. Mean student expenditures per school district ranged from $13,692.34 in 2009-2010 to $14,595.86 in 2012-2013. Standard deviations for all four years ranged from $2485.73 in 2009-2010 to $2883.26 in 2012-2013. The normality of the data was assessed through visual inspection of the frequency distributions. Each year of student expenditure frequency distributions approximated a normal curve upon inspection of a histogram. See Table 15.

For aid ratio, the market value/personal income (MV/PI) aid ratio for each school district for corresponding school years was utilized. Mean aid ratios were approximately .55 for each school year analyzed. Standard deviations for all four years were approximately .16. The normality of the data was assessed through visual inspection of the frequency distributions. Each year of student expenditure frequency distributions approximated a normal curve upon inspection of a histogram. See Table 16.

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to calculate the effect size and p-value coefficients of the resource availability as measured by student expenditure as well as school district aid ratio to determine the strength of the prediction of math proficiency and to examine the effect of distribution shapes. Student expenditure was categorized into four categories for analysis purposes: less than $12,400, greater than $12,400 to $13,700, greater than $13,700 to $15,500, and greater than $15,500. These cut points were established in order to have close to equal distribution between group sizes. P-value coefficients of .0945 for the 1-way ANOVA and .0152 for the nonparametric Kruskal-Wallis test were obtained. A significant difference was not found between school district resource availability as measured by student expenditure for math proficiency on the third grade PSSA for the adjusted alpha level. Proficiency rates were converted to z-values for data analysis purposes. See Table 27.

It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in math in third grade, where stronger associations would be present in school districts with greater resource availability. A significant difference was not found between school district resource availability as measured by student expenditure for math proficiency on the third grade PSSA. This hypothesis was therefore rejected.

Table 27

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Math Proficiency by Student Expenditure per Average Daily Membership

DESCRIPTIVE STATISTICS -

VARIABLE	n	Mean	S.D.	Range
<$12,400	128	86.22	6.23	65.10-97.10
>$12,400-$13,700	123	84.03	6.29	67.02-98.42
>$13,700-$15,500	122	85.51	7.76	52.87-96.75
>$15,500	126	84.25	10.81	34.87-96.90

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
<$12,400	128	0.15	0.77	-2.48-1.50
>$12,400-$13,700	123	-0.12	0.78	-2.24-1.67
>$13,700-$15,500	122	0.06	0.96	-4.00-1.46
>$15,500	126	-0.09	1.34	-6.24-1.48

ANALYSIS OF VARIANCE -

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Student Expenditure	3	2.14	.0945	.0127	10.43	3	.0152	.0209

Market value/personal income aid ratio was categorized into four categories for analysis purposes: less than .46, greater than .46 to .59, greater than .59 to .68, and greater than .68. These cut points were established in order to have close to equal distribution between group sizes. These cut points were established in order to have close to equal distribution between group sizes. P-value coefficients of <.0001 for the 1-way ANOVA and <.0001 for the nonparametric Kruskal-Wallis test were obtained. These indicated a significant difference between resource availability as measured by school district market value/personal income aid ratio for the math proficiency rates on the third grade PSSA. Proficiency rates were converted to z-values for data analysis purposes. See Table 28.

It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in math in third grade, where stronger associations would be present in school districts with greater resource availability. Resource availability as measured by market value/personal income aid ratio indicated a significant difference for math proficiency in third grade on the PSSA. This indicated that school districts with lower aid ratios were more likely to have higher math proficiency rates in third grade on the PSSA.

Table 28

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Math Proficiency by Market Value/Personal Income Aid Ratio

DESCRIPTIVE STATISTICS -

VARIABLE	n	Mean	S.D.	Range
<.46	130	89.41	5.31	69.72-98.02
>.46-.59	121	86.67	5.43	69.97-98-42
>.59-.68	125	84.26	6.49	54.85-96.82
>.68	123	79.49	10.32	34.87-94.95

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
<.46	130	0.54	0.66	-1.90-1.62
>.46-.59	121	0.20	0.67	-1.87-1.67
>.59-.68	125	-0.09	0.80	-3.75-1.47
>.68	123	-0.68	1.28	-6.24-1.23

ANALYSIS OF VARIANCE -

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Aid Ratio	3	43.24	<.0001**	.2076	107.34	3	<.0001**	.2155

POST HOC -

SCHEFFE	Estimate	Std. Error	df	t	P>|t|	Adj. P
<.46 vs. >.46-.59	.3419	.1128	495	3.03	.0026	.0278
<.46 vs. >.59-.68	.6411	.1118	495	5.73	<.0001	<.0001
<.46 vs. >.68	1.2356	.1123	495	11.00	<.0001	<.0001
>.46-.59 vs. >.59-.68	.2993	.1139	495	2.63	.0088	.0763
>.46-.59 vs. >.68	.8937	.1143	495	7.82	<.0001	<.0001
>.59-.68 vs. >.68	.5945	.1134	495	5.24	<.0001	<.0001

MANN-WHITNEY U	Class	Mean Rank	Sum of Ranks	Cases	z	p
<.46 vs. >.46-.59	1	144.72	18814	130	-4.23	<.0001
	2	105.88	12812	121		
<.46 vs. >.59-.68	3	95.96	11995	125	-6.80	<.0001
	1	158.80	20645	130		
<.46 vs. >.68	4	83.03	10213	123	-9.29	<.0001
	1	168.60	21918	130		
>.46-.59 vs. >.59-.68	3	110.64	13830	125	2.88	.0043
	2	136.78	16551	121		
>.46-.59 vs. >.68	4	94.17	11583	123	6.32	<.0001
	2	151.29	18307	121		
>.59-.68 vs. >.68	4	106.58	13110	123	-3.90	.0001
	3	142.12	17766	125		

Note. **Indicates significant difference at .008

Population density was examined by reporting the urban-centric code for each school district for corresponding years in the study. The urban-centric code was reported for 498 school districts. One school district did not have an urban-centric code assigned and was not utilized as part of the analysis for population density. The urban-centric code for each school district was consistent between school years examined. School districts fell into 1 of 12 urban-centric code categories: 1-City:Small, 2-City:Midsize, 3-City:Large, 4-Suburb:Small, 5-Suburb:Mid-size, 6-Suburb:Large, 7-Town:Fringe, 8-Town:Distant, 9-Town:Remote, 10-Rural:Fringe, 11-Rural:Distant, and 12-Rural:Remote. Frequencies ranged from n=2 for both City: Midsize and City: Large to n=166 for Suburb: Large. Therefore, the average school district analyzed had an urban-centric code of Suburb: Large. See Table 19. Because the number of school districts had such a diverse range per urban-centric code category, these categories were condensed for analysis purposes.

Population density as measured by urban-centric code was condensed into three categories for analysis purposes: City-Suburb, Town, and Rural. These cut points were established in order to have close to equal distribution between group population density sizes. P-value coefficients of .3031 for the 1-way ANOVA and .0119 for the nonparametric Kruskal-Wallis test were obtained. A significant difference was not found between population density for math proficiency on the 1-way ANOVA or the Kruskal-Wallis test for the adjusted alpha level. Proficiency rates were converted to z-values for data analysis purposes. See Table 29.

It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding math proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding math proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. A significant difference was not found between population density for math proficiency on the 1-way ANOVA or the Kruskal-Wallis test for the adjusted alpha level. This hypothesis was therefore rejected.

Table 29

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Math Proficiency by Population Density

DESCRIPTIVE STATISTICS

VARIABLE	n	Mean	S.D.	Range
City-Suburb	224	84.79	10.34	34.87-98.02
Town	100	84.26	5.54	70-20-94-55
Rural	174	85.72	5.38	73.12-98.42

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
City-Suburb	224	-0.02	1.28	-6.24-1.62
Town	100	-0.09	0.69	-1.84-1.18
Rural	174	0.08	0.67	-1.48-1.67

ANALYSIS OF VARIANCE

Source of Variation	PARAMETRIC df	F	p	n^2	KRUSKAL-WALLIS Chi-Square	df	p	n^2
U-C Code	2	1.20	.3031	.0048	8.86	2	.0119	.0178

Interaction density was examined by calculating the student teacher ratio for school district for corresponding years in the study. Student teacher ratio was calculated by the average daily membership for each school district divided by the number of teachers employed for each school district. Mean student teacher ratios ranged from 14.47 in 2009-2010 to 15.04 in 2012-2013. Standard deviations for all four years ranged from 1.80 in 2009-2010 to 2.51 in 2012-2013. The normality of the data was assessed through visual inspection of the frequency distributions. Each year of interaction density frequency distributions approximated a normal curve upon inspection of a histogram. See Table 20.

Interaction density as measured by student teacher ratio was categorized into four categories for analysis purposes: less than 13.6, greater than 13.6 to 14.7, greater than 14.7 to 15.7, and greater than 15.7. These cut points were established in order to have close to equal distribution between group sizes. P-value coefficients of .2629 for the 1-way ANOVA and .4760 for the nonparametric Kruskal-Wallis test were obtained. These did not indicate a significant difference between interaction density as measured by student teacher ratio for the math proficiency rates on the third grade PSSA. Proficiency rates were converted to z-values for data analysis purposes. See Table 30.

Proficiency status was examined by school district annual yearly progress (AYP) status for corresponding years in the study. School districts fell into 1 of 7 proficiency categories: 1-Made AYP, 2-Warning, 3-School Improvement I, 4-School Improvement II, 5-Making Progress, 6-Corrective Action I, and 7-Corrective Action II. Proficiency status for 499 school districts was reported for 2010, 2011, and 2012. Proficiency status for 498 school districts was reported for 2009. See Table 23. The vast majority of school districts had Made AYP proficiency status going into the third grade

PSSA for at least one of the years analyzed for the study. Therefore, the average school district had Made AYP proficiency status. As a result, the categories were condensed for analysis purposes.

Table 30

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Math Proficiency by Interaction Density

DESCRIPTIVE STATISTICS -

VARIABLE	n	Mean	S.D.	Range
<13.6	127	86.00	7.15	52.20-96.90
>13.6-14.7	124	84.51	7.49	46.15-96.82
>14.7-15.7	127	85.33	6.51	64.70-96.82
>15.7	121	84.15	10.46	34.87-98.42

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
<13.6	127	0.12	0.89	-4.08-1.48
>13.6-14.7	124	-0.06	0.93	-4.84-1.47
>14.7-15.7	127	0.03	0.81	-2.53-1.47
>15.7	121	-0.10	1.30	-6.24-1.67

ANALYSIS OF VARIANCE -

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
Student/Teacher Ratio	3	1.33	.2629	.0080	2.49	3	.4760	.005

Proficiency status as measured by AYP status was condensed into five categories for analysis purposes: Made AYP all 4 years, Made AYP 3 out of 4 years, Made AYP 2 out of 4 years, Made AYP 1 out of 4 years, or Did Not Make AYP in any of the 4 years. P-value coefficients of <.0001 for the 1-way ANOVA and <.0001 for the parametric Kruskal-Wallis test were obtained. This indicated a significant difference between proficiency status as measured by AYP status for the math proficiency rates on the third grade PSSA. See Table 31.

It was hypothesized that school district AYP status would predict math proficiency, where school districts that had met AYP standards would have higher math proficiency in third grade. Proficiency status as measured by AYP status indicated a significant difference for math proficiency in third grade on the PSSA. This indicated that school districts that had made AYP the previous school year were likely to have higher proficiency rates in math the following year on the third grade PSSA.

Table 31

Comparison of 1-way Analysis of Variance and Nonparametric Kruskal-Wallis Tests of Math Proficiency by Proficiency Status

DESCRIPTIVE STATISTICS -

VARIABLE	n	Mean	S.D.	Range
Made AYP 4 Years	295	87.74	5.37	71.22-98.42
Made AYP 3/4 Years	159	83.85	6.60	52.20-95.90
Made AYP 2/4 Years	21	78.58	5.52	70.20-88.90
Made AYP 1/4 Years	8	66.85	16.02	34.87-85.02
Did Not Make AYP	16	63.76	8.92	46.15-77.20

VARIABLE(z)	n(z)	Mean(z)	S.D.(z)	Range(z)
Made AYP 4 Years	295	0.33	0.66	-1.71-1.67
Made AYP 3/4 Years	159	-0.14	0.82	-4.08-1.35
Made AYP 2/4 Years	21	-0.80	0.68	-1.84-0.48
Made AYP 1/4 Years	8	-2.26	1.99	-6.24—0.01
Did Not Make AYP	16	-2.64	1.11	-4.84-(-0.97)

ANALYSIS OF VARIANCE -

	PARAMETRIC				KRUSKAL-WALLIS			
Source of Variation	df	F	p	n^2	Chi-Square	df	p	n^2
AYP Status	4	85.52	<.0001**	.4091	119.54	4	<.0001**	.2400

POST HOC -

VARIABLE	KEY
Made AYP 4 years	0
Made AYP 3/4 years	1
Made AYP 2/4 years	2
Made AYP 1/4 years	3
Did Not Make AYP	4

SCHEFFE	Estimate	Std. Error	df	t	P>|t|	Adj. P
0 vs. 1	.4837	.0793	494	6.37	<.0001	<.0001
0 vs. 2	1.1400	.1743	494	6.54	<.0001	<.0001
0 vs. 3	2.6008	.2765	494	9.40	<.0001	<.0001
0 vs. 4	2.9861	.1981	494	15.07	<.0001	<.0001
1 vs. 2	.6563	.1792	494	3.66	.0003	.0101
1 vs. 3	2.1171	.2796	494	7.57	<.0001	<.0001
1 vs. 4	2.5024	.2024	494	12.36	<.0001	<.0001
2 vs. 3	1.4608	.3207	494	4.56	<.0001	.0004
2 vs. 4	1.8461	.2561	494	7.21	<.0001	<.0001
1 vs. 4	.3853	.3342	494	1.15	.2495	.8562

MANN-WHITNEY U	Class	Mean Rank	Sum of Ranks	Cases	z	p
0 vs. 1	1	175.24	27863.50	159	-6.23	<.0001
	0	255.66	75421.50	295		
0 vs. 2	2	46.40	974.50	21	-5.81	<.0001
	0	166.47	49111.50	295		
0 vs. 3	0	155.61	45906.50	295	-4.35	<.0001
	3	18.68	149.50	8		
0 vs. 4	4	9.75	156.00	16	-6.67	<.0001
	0	163.93	48360.00	295		
1 vs. 2	1	95.87	15243.50	159	-3.80	.0002
	2	49.83	1046.50	21		
1 vs. 3	1	87.10	13850.00	159	-3.69	.0003
	3	22.25	178.00	8		
1 vs. 4	1	95.53	15190.00	159	-6.19	<.0001
	4	13.12	210.00	16		
2 vs. 3	2	17.14	360.00	21	-2.17	.0385
	3	9.37	75.00	8		
2 vs. 4	2	26.09	548.00	21	-4.55	<.0001
	4	9.68	155.00	16		
3 vs. 4	4	11.31	181.00	16	1.13	.2689
	3	14.87	119.00	8		

Note. **Indicates significant difference at .008

Research Question 3

Spearman's Rho was utilized to explore associations between the latent variables. The latent variables were resource availability, population density, interaction density, and proficiency status. Resource availability was measured by student expenditure by average daily membership as well as school district aid ratio market value/personal income. Population density was measured by the urban-centric code. Interaction density was measured by student teacher ratio. Finally, school district proficiency status was measured by AYP status. Because resource availability was analyzed by two separate metrics, two Spearman's Rho correlation matrices were analyzed: one as measured by student expenditure by average daily membership and the other by school district aid ratio market value/personal income. It was hypothesized that associations would exist between the following latent variables: resources availability, population density, interaction density, and school district AYP status. See Table 32 and Table 33.

Table 32

Spearman's Rho Correlation Matrix for Resource Availability as Measured by Student Expenditure per Average Daily Membership, Population Density, Interaction Density, and Proficiency Status Latent Variables

DESCRIPTIVE STATISTICS

Variable	n	Mean	S.D.	Range
Resource Availability(RA)				
-Student Expenditure (SE)	499	2.49	1.12	1.00-4.00
Population Density (PD)	498	2.10	0.88	1.00-3.00
Interaction Density (ID)	499	2.48	1.11	1.00-4.00
Proficiency Status (PS)	499	3.42	0.90	0.00-4.00

SPEARMAN'S RHO CORRELATION MATRIX

	Resource Avail	Population Density	Interaction Density	Proficiency Status
Resource Availability -Student Expenditure	1.00	.07 p=.095	-.39 p<.001	-.01 p=.825
Population Density		1.00	.28 p<.001	-.18 p<.001
Interaction Density			1.00	-.13 p=.002
Proficiency Status				1.00

Small correlations were found between multiple latent variables when resource availability was observed by student expenditure. Cohen's (1992) definitions of small (.20), medium (.50), and large (.80) were used to describe the relationships between the variables. These included a small positive correlation between population density and interaction density (r=.28) as well as a small negative correlation between resource availability as measured by student expenditure and interaction density (r=-.38). The p-values for these correlations were all less than .05, indicating that there was less than a 5% chance that the strength of these relationships happened by chance. These associations were consistent with the latent variable hypotheses.

Table 33

Spearman's Rho Correlation Matrix for Resource Availability as Measured by School District Aid Ratio Market Value/Personal Income, Population Density, Interaction Density, and Proficiency Status Latent Variables

DESCRIPTIVE STATISTICS

Variable	n	Mean	S.D.	Range
Resource Availability -Aid Ratio	499	2.48	1.12	1.00-4.00
Population Density	498	2.10	0.88	1.00-3.00
Interaction Density	499	2.48	1.11	1.00-4.00
Proficiency Status	499	3.42	0.90	0.00-4.00

SPEARMAN'S RHO CORRELATION MATRIX

	Resource Avail	Population Density	Interaction Density	Proficiency Status
Resource Availability -Aid Ratio	1.00	-.25 p<.001	-.09 p=.030	-.21 p<.001
Population Density		1.00	.28 p<.001	-.18 p<.001
Interaction Density			1.00	-.13 p=.002
Proficiency Status				1.00

Small correlations were found between multiple latent variables when resource availability was observed by aid ratio. These included a small positive correlation between population density and interaction density (r=.28) as well as a small negative correlations between resource availability as measured by aid ratio and population density (r=-.25) as well as proficiency status (r=-.21). The p-values for these correlations were all less than .05, indicating that there was less than a 5% chance that the strength of these relationships happened by chance. These associations were consistent with the latent variable hypotheses.

Additional Pearson parametric correlations as well as Kendall's Tau B non-parametric correlations were conducted to further analyze the relationships between the latent variables. See Tables 34 and 35. The resource availability and interaction density latent variable are both continuous. For this reason, Pearson parametric correlations were calculated. Scatterplots for the continuous variables were examined to verify the assumption of linearity. Examination of these plots determine that the linearity assumption was not violated. The population density and proficiency status latent variable are categorical. Therefore, the nonparametric Kendall's Tau B were also conducted to examine the associations.

Table 34

Pearson Parametric Correlation Matrix for Resource Availability as Measured by Student Expenditure per Average Daily Membership, Population Density, Interaction Density, and Proficiency Status Latent Variables

DESCRIPTIVE STATISTICS

Variable		n	Mean	S.D.	Range
Resource Availability	(RA)				
-Student Expenditure	(SE)	499	14119	2328	9844-26443
Population Density	(PD)	498	7.62	2.53	1.00-12.00
Interaction Density	(ID)	499	14.74	1.99	7.77-36.05
Proficiency Status	(PS)	499	1.29	0.93	1.00 -7.00

PEARSON PARAMETRIC CORRELATION MATRIX

	Resource Avail	Population Density	Interaction Density	Proficiency Status
Resource Availability -Student Expenditure	1.00	-.002 p=.963	-.34 p<.001	.070 p=.116
Population Density		1.00	-.30 p<.001	.32 p<.001
Interaction Density			1.00	.32 P<.001
Proficiency Status				1.00

Minimal correlations were found between several of the latent variables when resource availability was observed by student expenditure using parametric correlation procedures. These included small positive correlations between population density and proficiency status (r=.32) as well as interaction density and proficiency status (r=.32). Small negative correlations were also found between resource availability as measured by student expenditure and interaction density (r=-.34) as well as population density and interaction density (r=.-30). The p-values for these correlations were all less than .05, indicating that there was less than a 5% chance that the strength of these relationships happened by chance. These associations were consistent with the latent variable hypotheses.

Table 35

Pearson Parametric Correlation Matrix for Resource Availability as Measured by School District Aid Ratio Market Value/Personal Income, Population Density, Interaction Density, and Proficiency Status Latent Variables

DESCRIPTIVE STATISTICS

Variable	n	Mean	S.D.	Range
Resource Availability -Aid Ratio	499	0.55	0.16	0.15-0.87
Population Density	498	2.10	0.88	1.00-3.00
Interaction Density	499	2.48	1.11	1.00-4.00
Proficiency Status	499	3.42	0.90	0.00-4.00

PEARSON PARAMETRIC CORRELATION MATRIX

	Resource Avail	Population Density	Interaction Density	Proficiency Status
Resource Availability -Aid Ratio	1.00	-.18 p<.001	.03 p=.423	.21 p<.001
Population Density		1.00	-.30 p<.001	.32 p<.001
Interaction Density			1.00	.32 P<.001
Proficiency Status				1.00

Minimal correlations were found between several of the latent variables when resource availability was observed by aid ratio using Pearson parametric correlation procedures. These included a small positive correlation between proficiency stats and aid ratio (r=.21), population density (r=.32), and interaction density (r=.32). A small negative correlation was also found between population density and interaction density (r=-.30). The p-values for these correlations were all less than .05, indicating that there was less than a 5% chance that the strength of these relationships happened by chance. These associations were consistent with the latent variable hypotheses.

Kendall's Tau B nonparametric correlations were also conducted to further analyze the relationships between the latent variables. The population density and proficiency status latent variable are categorical. For this reasoning, nonparametric Kendall's Tau B were also conducted to examine these associations.

Minimal correlations were found between several of the latent variables when resource availability was observed by student expenditure using Kendall's Tau B nonparametric correlation procedures. These included small negative correlations between resource availability as measured by student expenditure and interaction density (r=-.32) as well as population density and interaction density (r=.-24). The p-values for these correlations were all less than .05, indicating that there was less than a 5% chance that the strength of these relationships happened by chance. These associations were consistent with the latent variable hypotheses. See Table 36.

Minimal correlations were again found between several of the latent variables when resource availability was observed by aid ratio using Kendall's Tau B nonparametric correlation procedures. These included a small negative correlation between population density and interaction density (r=-.24). The p-values for this correlation was less than .05, indicating that there was less than a 5% chance that the strength of this relationship happened by chance. This association was consistent with the latent variable hypotheses. See Table 37.

Table 36

Kendall's Tau B Correlation Matrix for Resource Availability as Measured by Student Expenditure per Average Daily Membership, Population Density, Interaction Density, and Proficiency Status Latent Variables

DESCRIPTIVE STATISTICS

Variable		n	Mean	S.D.	Range
Resource Availability	(RA)				
-Student Expenditure	(SE)	499	14119	2328	9844-26443
Population Density	(PD)	498	7.62	2.53	1.00-12.00
Interaction Density	(ID)	499	14.74	1.99	7.77-36.05
Proficiency Status	(PS)	499	1.29	0.93	1.00 -7.00

KENDALL'S TAU B MATRIX

	Resource Avail	Population Density	Interaction Density	Proficiency Status
Resource Availability -Student Expenditure	1.00	.0007 p=.980	-.32 p<.001	.01 p=.758
Population Density		1.00	-.24 p<.001	-.18 p<.001
Interaction Density			1.00	.10 p=.003
Proficiency Status				1.00

Table 37

Kendall's Tau B Correlation Matrix for Resource Availability as Measured by School District Aid Ratio Market Value/Personal Income, Population Density, Interaction Density, and Proficiency Status Latent Variables

DESCRIPTIVE STATISTICS

Variable	n	Mean	S.D.	Range
Resource Availability				
-Aid Ratio	499	0.55	0.16	0.15-0.87
Population Density	498	2.10	0.88	1.00-3.00
Interaction Density	499	2.48	1.11	1.00-4.00
Proficiency Status	499	3.42	0.90	0.00-4.00

KENDALL'S TAU B CORRELATION MATRIX

	Resource Avail	Population Density	Interaction Density	Proficiency Status
Resource Availability -Aid Ratio	1.00	.17 p<.001	-.06 p=.423	.19 p<.001
Population Density		1.00	-.24 p<.001	-.18 p<.001
Interaction Density			1.00	.10 P=.003
Proficiency Status				1.00

Summary

The chapter reviewed the results for this study. This included a description of study complications, computer programs, and analysis of research findings. The results of both the 1-way ANOVA and nonparametric Kruskal-Wallis tests indicated significant differences between the long and short instructional years regarding reading and math proficiency on the third grade PSSA. However, the results indicated that proficiency rates in reading and math were higher during years with fewer weeks of instruction prior to PSSA administration compared to years with greater weeks of instruction. This was contradictory to the study hypothesis. Additionally, the latent variables resource availability as measured by aid ratio market value/personal income, population density, and school district proficiency status were also found to be significant predictors of reading proficiency on the third grade PSSA. The latent variables of resource availability as measured by aid ratio market value/personal income and school district proficiency status were also found to be significant predictors of math proficiency on the third grade PSSA. Small positive and negative correlations were also found between multiple latent variables through Spearman's Rho.

CHAPTER FIVE

DISCUSSION

The purpose of this study was to examine varying instructional time across four academic school years and the resulting school district third grade proficiency rates in reading and mathematics on the Pennsylvania System of School Assessment (PSSA). The testing windows outlined by the Pennsylvania Department of Education (PDE) varied between academic years examined in this study. This resulted in a difference in the weeks of instruction prior to the administration of PSSA assessments between school years where the PSSA assessments were administered in March (defined as short years) versus when they were administered in April (defined as long years). This study sought to determine if this variance was a factor with respect to school district performance on PSSA assessments. This research study provides potential implications for current high-stakes assessment practices in the Commonwealth of Pennsylvania, particularly the potential impact of varying weeks of instruction prior to PSSA administration on defined student achievement. A thorough analysis of the variables examined in this study could be utilized for recommendations that will help to improve current commonwealth practices of assessing reading and mathematics proficiency. Therefore, this study may provide useful information to educators and state officials so that PSSA assessments are given at an appropriate time to accurately measure acquisition and retention of state curriculum standards.

Additional variables and their relationships with reading and math proficiency were also examined. Specifically, this research study set out to determine the following:

(1) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area of reading in third grade?

(2) Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area of mathematics in third grade?

(3) Do any associations exist among the following variables: resources availability, population density, interaction density, and school district annual yearly progress status?

In order to examine the relationships that each variable had with the outcomes, 1-way Analysis of Variance (ANOVA) and nonparametric Kruskal-Wallis tests approaches were applied. 1-way ANOVA and nonparametric Kruskal-Wallis tests were used for data analysis for Research Questions 1 and 2 for each ancillary variable because of the normality assumption being violated for the outcome variables. This was due to school district proficiency scores in both reading and math being skewed towards higher levels of proficiency. For this purpose, both 1-way ANOVA and nonparametric Kruskal-Wallis tests were used for data analysis to examine the effect of distribution shapes. The population for analysis was 499 of the 500 Pennsylvania school districts. One school district was excluded from analysis due to not having available data for many of the ancillary variables as well as the outcome variables.

The results the 1-way ANOVA indicated a significant difference between the long and short instructional years regarding reading and math proficiency on the third grade PSSA. However, the results indicated that proficiency rates in reading and math were higher during years with fewer weeks of instruction prior to PSSA administration compared to years with greater weeks of instruction. This was because mean proficiency rates were higher during years with less of weeks of instruction prior to the administration of the PSSA in math for third grade. This was contradictory to the study hypothesis. The findings may be the result of differences between individual test items, quality of curriculum, quality of instruction, and student and/or teacher fatigue between school years. Additionally, the latent variables resource availability as measured by aid ratio market value/personal income, population density, and school district proficiency status were also found to be significant predictors of reading proficiency on the third grade PSSA. The latent variables of resource availability as measured by aid ratio market value/personal income and school district proficiency status were also found to be significant predictors of math proficiency on the third grade PSSA.

Spearman's Rho was utilized in order to examine the relationships between latent variables for Research Question 3. Additionally, Pearson parametric correlations as well as Kendall's Tau B non-parametric correlations were conducted to further analyze the relationships between the latent variables. Small positive and negative correlations were also found between multiple latent variables.

The following sections will discuss the results in detail of this study. The research questions will be reflected in depth and discussed with relevant literature. The findings will be explained along with a discussion on the study limitations and implications. Recommendations for future research will also be discussed based upon the data and results collected.

Research Question 1

Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area of reading in third grade?

It was hypothesized that weeks of instruction would predict the proficiency rate in the area of reading in third grade on PSSA assessments, where reading proficiency would be positively correlated with the amount of instruction prior to the assessment administration. The variables involved with this research question included the weeks of instruction during the year of administration and reading proficiency. An average of the weeks of instruction for the two years where PSSA assessments were conducted in short instruction years as well as an average for the two years the PSSA assessments were conducted in long instruction years for each school district were calculated. The average for each variable and district was the data analyzed. For 2010-2011 and 2011-2012 (short years), mean weeks of instruction of 28.01 and 27.83 were obtained. For 2009-2010 and 2012-2013 (long years), mean weeks of instruction of 31.51 and 31.87 were obtained.

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to calculate the effect size and p-value coefficients of the weeks of instruction variable to determine the strength of the prediction of reading proficiency and to examine the effect of distribution shapes. The results the 1-way ANOVA indicated a significant difference between the long and short instructional years regarding reading proficiency on the third grade PSSA. However, the hypothesis of higher proficiency rates during longer instructional years was rejected. This was because mean proficiency rates were higher during years with less of weeks of instruction prior to the administration of the PSSA in reading for third grade. A significant difference was not found on the nonparametric Kruskal-Wallis test with an adjusted alpha level of .008. This was due to the data distribution shape.

There are multiple possible causes that could explain the differences between the reading proficiency rates on the PSSA between the short and long instructional years. These differences may include, but are not limited to, differences between the individual test items, quality of the curriculum, quality of the instruction, and potential student and/or teacher fatigue between school years. PDE has defined anchor content standards and eligible content for PSSA assessments aligned with the Pennsylvania curricular standards despite variation in administration timelines. The anchor content standards and eligible content were implemented beginning with the 2007 PSSA assessment (Data Recognition Corporation, 2013). These were established in response to educator concerns regarding the quantity and detail of the state academic standards in order to indicate which parts of the standards would be assessed on the PSSA assessments (DRC, 2008). In addition to content standards and eligible content, PDE also established scale score benchmarks to define individual student proficiency rates in the areas of reading and mathematics in the Technical Report for the PSSA (2008). These established scale scores have been the benchmarks utilized to define proficiency rates in reading and mathematics for third graders in Pennsylvania since that time. However, despite establishing content standards and benchmarks for consistency between school years, the PSSA assessments themselves along with the individual test items differ between school years. The individual differences in the make-up of the assessments and corresponding test items may have indirectly led to the differences between the reading proficiency rates between short and long instructional years.

Differences in curricular practices may have also contributed to the findings between short and long instructional years on reading proficiency rates on the third grade PSSA. School districts have the liberty to choose their own curricular materials or prescribed series of activities that are aligned with commonwealth curricular standards in Pennsylvania in order to meet local students' needs (PDE, 2014). Therefore, variance exists between published curricular materials and textbooks across individual school districts since the use of a particular textbook publication is not mandated. Further, it is also likely that multiple school districts may have changed and/or updated their published curricular materials during the school years examined in this study. Such changes may also have had an impact on the proficiency rates between short and long instructional years.

Along with differences in textbook and/or published curricular materials across school districts, differences in instructional practices may have also contributed to the findings. Individual staffing changes at the school district level were likely during the school years examined in this study. Changes to the school district third grade faculty through retirements, attrition, or grade-level staffing may have impacted the differences of proficiency rates in reading. School district instructional personnel differences between school years may have contributed to the variances in reading proficiency rates on the third grade PSSA.

Additionally, it is believed that fatigue may have played a role in the study findings. Kovaleski, VanDerHeyden, and Shapiro (2013) have explored differences between student rates of improvement in response to reading interventions matched to student deficits. There is a trend of greater rates of improvement in response to reading interventions when comparing student growth from fall/winter to winter/spring, where greater growth is generally noted in the fall. This trend can be generalized to the results of this study, where higher rates of reading proficiency were found on the PSSA during the short instructional years compared to the long instructional years. Moreover, these trends of increased demonstrated achievement earlier in the academic year support a hypothesis of student fatigue playing a role in such observed differences.

The belief that instructional time has a positive impact on student achievement has resulted in educational policies attempting to maximize time for instruction (Aronson, Zimmerman, & Carlos, 1999). Initiatives have included the Expanded Learning Time project in Massachusetts (ELT, 2010), as well as other state-level policy initiatives in Washington, Maryland, Connecticut, and Hawaii among others (Farban et al., 2011). School districts nationally have reported overall increases on curricular time spent on reading and mathematics as the result state testing requirements (Retner et al., 2006). Internationally, the Organization for Economic Co-Operation and Development (OECD, 2008) has concluded that instructional time is a necessary factor to be considered in student achievement as well as allocating education funding despite comparing counties with different curriculum policies and priorities.

Despite these policy trends, the research is divided on the impact of increased instructional time on reading achievement. Studies by Marcotte (2007), Ginsburg and Chudowsky (2012), and Blank (2013) specific to natural learning breaks, including absenteeism, summer vacation, and snow days, have concluded that time in school is an important variable which affects achievement outcomes. Long (2014) found in a meta-analysis of studies involving instructional time varying effects in cross-sectional survey research within and between countries. However, this study also found no correlation between time in school and student achievement on the 2000 Program for International Student Achievement (PISA). On the contrary, the same study did find a statistically significant effect of subject specific instructional time at the school level in both reading and mathematics when time for the subjects was increased by 1 hour on the 2006 PISA. Moreover, measurements of instructional time differed on the 2000 and 2006 PISA surveys, where the former relied on school administrator reports and the latter was based on student reports of time spent on instruction. As a result, it was concluded that the length of the school year had no effect on academic achievement. It was also concluded that the specific uses of time in school had a strong impact on student achievement.

Even with being considered an essential factor in educational outcomes, the research has found instructional time to be limited and conflicting with respect to its causal effect of later outcomes (Kikuchi, 2014). Baker et al. (2004) argued that instructional time is an educational resource not worthy of the policy attention that it has received based upon the limited to nonexistent correlations between time spent on instruction and student achievement. They recommended that policymakers instead should use resources to improve initiatives with teachers and curricula.

The results of this study found a significant difference between weeks of instruction and reading proficiency on the third grade PSSA. Further, the results indicated higher proficiency rates in reading during the school years with less weeks of instruction prior to the administration of the PSSA. Therefore, the current findings are consistent with conclusions that the impact of instructional time on student achievement is a complex issue within the literature, with no definitive or causal explanations (Pennington, 2006). Further, literature has also supported the belief that the impact of instructional time is not as important as how the actual time of instruction is spent (Joyner & Molina, 2011). The findings of this study would support this conclusion in its analysis of instructional time and student achievement in reading.

Additional 1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to examine differences in the outcome variables which were related to the predictor variables. The additional variables included district resource availability, district population density, district interaction density, and district proficiency status. District resource availability was examined by two different latent variables for the purpose of this study: per student expenditure and school district aid ratio. District population density was examined by reporting the urban-centric code for each school district for corresponding years in the study. District interaction density was examined by calculating the school district student teacher ratio for corresponding years in the study. Finally, district proficiency status was examined by school district annual yearly progress (AYP) status for corresponding years in the study.

It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in reading in third grade, where stronger associations would be present in school districts with greater resource availability. Resource availability as measured by student expenditure did not indicate a significant difference for reading proficiency in third grade on the PSSA. However, resource availability as measured by market value/personal income aid ratio indicated a significant difference for reading proficiency in third grade on the PSSA. This indicated that school districts with lower aid ratios were more likely to have higher reading proficiency rates in third grade on the PSSA.

The current study findings are consistent with literature trends examining expenditure resources and student achievement. In a study by DeLuca and Hinshaw (2013), the authors found that the use of instructional expenditure percentages were a low or inconclusive predictor of achievement. The authors also suggested that school district income levels were a more useful predictor of student achievement compared to expenditure percentages. However, Turner (1999) found a moderate association between reading achievement of fifth grade students in Georgia and expense per pupil. Jones and Slate (2011) found that school districts that spent less than 60% on instruction had the lowest percentages of passing rates on the Texas Assessment of Knowledge and Skills (TAKS) assessment in reading and writing among other subjects. Additionally, the authors suggested that financial variables are to be considered as having a potential impact on student achievement. These conclusions are consistent with the current study findings.

It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding reading proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. A significant difference was not found between population density for reading proficiency on the 1-way ANOVA.

However, a significant difference was found between population density for reading proficiency as measured by the nonparametric Kruskal-Wallis test. This was because the distribution shape had an effect on the 1-way ANOVA. This indicated that school districts classified as City-Suburb were more likely to have higher proficiency rates in reading compared to those classified as Town or Rural for analysis purposes using the Kruskal-Wallis.

The current findings are consistent with literature trends regarding population density and academic achievement, where multiple studies have concluded that students from urban areas perform better on standardized achievement tests compared to their rural counterparts (Borland & Howsen, 1999). DeYoung (1985) found that increased income from mining in the Appalachian region of Kentucky to be associated with below average achievement and a lower expense per pupil in comparison to state areas less dependent on the mining industry. Broomhall and Johnson (1994) examined students from rural areas. The authors found that students who were less willing to move along with a less positive perception of local employment opportunities tended to have a more negative perception of the need for education and performed more poorly in school in comparison to students who were more willing to move from their rural areas. Broomhall (1995) followed up this study and concluded that both economic and social conditions in the Appalachian region of the United State were below those of the rest of the country. Additional studies have found similar trends regarding population density and academic achievement. Borland and Howsen (1999) compared the academic performance of students from rural and urban areas to those from areas of moderate population density in the state of Kentucky. The authors found that third grade students from areas of moderate population density outperformed their rural and urban counterparts on cognitive and academic achievement assessments. The authors concluded that policies should be aimed at improving access to resources across population domains to increase incentives for educational outcomes.

It was hypothesized that school district interaction density would predict reading proficiency, where school districts that had lower student teacher ratios would have higher reading proficiency in third grade. A significant difference was not found between school district interaction density for reading proficiency on the third grade PSSA. This hypothesis was therefore rejected.

The current findings are somewhat contradictory to literature trends concerning student-teacher ratio and its impact on academic achievement. Iversen and Tunmer (1993) studied the effectiveness of one-on-one and small-group reading interventions and found evidence to support a lower student-teacher ratio. Vaughn et al. (2003) found that small intervention group sizes led to significantly higher gains in reading skills compared to larger group sizes. Begeny et al. (2011) found higher reading achievement outcomes following one-on-one and small group interventions compared to peer-dyed interventions. Although the results of these studies were supportive of lower student-teacher ratios resulting in greater achievement in reading, these studies were more focused on the impact of reading interventions rather than large-group instruction.

Finally, it was hypothesized that school district proficiency status would predict reading proficiency, where school districts that had met annual yearly progress (AYP) standards would have higher reading proficiency in third grade. Proficiency status as measured by AYP indicated a significant difference for reading proficiency in third grade on the PSSA. This indicated that school districts that had made AYP the previous school year were likely to have higher proficiency rates in reading the following year on the third grade PSSA.

The current findings are consistent with literature trends on the impact of proficiency status on academic achievement. The research has supported an increase in academic achievement as the result of policy initiatives which support school-based accountability pressure (Lauen & Gaddies, 2012). Positive gains have also been noted in reading achievement as the result of standards-based policies (Swanson, 2006). Figlio and Rouse (2006) found large improvement in both reading and mathematics as measured by state assessments since the implementation of state policies supporting school vouchers. Jacob (2005) examined the impact of accountability policies mandating demonstrated AYP on reading and mathematics achievement on state assessments in the Chicago Public Schools and found that reading and mathematics achievement increased following the implementation of accountability policies when comparing performance data from before and after their enactment.

Research Question 2

Do any of the following variables: weeks of instruction, resource availability, population density, interaction density, or school district annual yearly progress status predict the proficiency rate in the area of mathematics in third grade?

It was hypothesized that the weeks of instruction would predict the proficiency rate in the area of math in third grade on PSSA assessments, where math proficiency would be positively correlated with the amount of instruction prior to the assessment administration. The variables involved with this research question included the weeks of instruction during the year of administration and math proficiency. An average of the weeks of instruction for the two short instruction years, as well as an average for the two long instruction years for each school district were calculated. For 2010-2011 and 2011-2012 (short years), mean weeks of instruction of 28.01 and 27.83 were obtained. For 2009-2010 and 2012-2013 (long years), mean weeks of instruction of 31.51 and 31.87 were obtained. The average for each variable and district was the data analyzed.

1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to calculate the effect size and p-value coefficients of the weeks of instruction variable to determine the strength of the prediction of mathematics proficiency and to examine the effect of distribution shapes. These indicated a significant difference between the weeks of instruction for the mathematics proficiency rates on the third grade PSSA. The results the 1-way ANOVA indicated a significant difference between the long and short instructional years regarding math proficiency on the third grade PSSA. However, the hypothesis of higher proficiency rates during longer instructional years was rejected. This was because mean proficiency rates were higher during years with fewer weeks of instruction prior to the administration of the PSSA in mathematics for third grade. A significant difference was not found on the nonparametric Kruskal-Wallis test with an adjusted alpha level of .008. This was due to the data distribution shape.

Similar to the findings for reading proficiency, there are multiple possible causes that could explain the differences between the mathematics proficiency rates on the PSSA between the short and long instructional years. These differences may again include, but are not limited to, differences between the individual test items between school years, differences in the quality of the curriculum between school years, differences in the quality of the instruction delivered between school years, and the potential impact of student and teacher fatigue between school years. Specifically, differences between individual test items as well as variance between school district curricular materials and instructional personnel may have contributed to the study findings. Further, the findings for weeks of instruction for math proficiency are similar to the aforementioned factor descriptions for reading proficiency. Differences have been demonstrated in rates of improvement in response to math interventions between fall/winter and winter/spring in the same academic year (Kovaleski, VanDerHeyden, & Shapiro, 2013). Similarities between the rate of improvement trends between fall and spring along with the results of this study support the notion that student fatigue may play a role in such differences.

Instructional time has been a topic of interest within the research literature as a factor which might potentially increase student achievement (Long, 2014). Blank (2013) found that instructional time in the area of mathematics has increased to over 1 hour per day. Cooper et al. (1996) found that summer vacation resulted in approximately one month of grade-level growth lost on achievement assessments, where the impact was greatest for mathematic calculations and spelling. However, the literature has demonstrated conflicting results regarding the impact of instructional time on achievement in mathematics. Baker et al. (2004) examined mathematics achievement data and instructional time between nations. The authors found that the majority of countries analyzed showed no association between the hours spent on mathematics instruction and mathematics achievement. As such, the authors gave recommendations for policymakers to improve teacher and curriculum initiatives rather than focusing on increasing instructional time alone.

International comparisons have focused on instructional time in mathematics to compare achievement between countries. The Third International Mathematics and Science Survey (TIMSS, 1999) assessed eighth grade students in 38 nations to measure mathematics and science trends in achievement (Baker et al., 2004). An analysis of TIMSS data found that students in South Korea had higher mathematics achievement scores and attended school longer compared to American students (Mullis et al., 2001). Conversely, the full TIMMS survey did not find a significant correlation between mathematics achievement and instructional time as measured by length of school year as well as hours of instruction (Long, 2014).

Additional 1-way ANOVA and nonparametric Kruskal-Wallis tests were utilized to examine differences in the outcome variables which were related to the predictor variables. The additional variables included district resource availability, district population density, district interaction density, and district proficiency status. District resource availability was examined by two different latent variables for the purpose of this study: per student expenditure and school district aid ratio. District population density was examined by reporting the urban-centric code for each school district for corresponding years in the study. District interaction density was examined by calculating the school district student teacher ratio for corresponding years in the study. Finally, district proficiency status was examined by school district AYP status for corresponding years in the study.

It was hypothesized that an association would exist between district resource availability and school district proficiency percentages in mathematics in third grade, where stronger associations would be present in school districts with greater resource availability. Resource availability as measured by student expenditure did not indicate a significant difference for mathematics proficiency in third grade on the PSSA. However, resource availability as measured by market value/personal income aid ratio indicated a significant difference for mathematics proficiency in third grade on the PSSA. This indicated that school districts with lower aid ratios were more likely to have higher mathematics proficiency rates in third grade on the PSSA.

The current findings are consistent with literature trends for resource availability and academic achievement. Despite policy initiatives to the contrary, direct correlations between financial resources and student achievement have been variable in the literature (DeLuca & Hinshaw, 2013).

Roper (1996) examined the relationship between student achievement and instructional expenditures in Alabama. The author found that school districts on the far ends of expenses did not have a correlation with achievement with student achievement on the Stanford Achievement Test (SAT). School districts in the middle range of spending were found to have associations with achievement. Rodriguez and Slate (2009) found that Texas school districts with Academically Unacceptable rates were more likely to spend less per student compared to high achieving school districts. DeLuca and Hinshaw (2014) analyzed expenditure distribution in Ohio as a predictor of student achievement. The authors concluded that the percentage of instructional expenses was a poor predictor of student achievement. Further, the authors suggested that school district income levels were a more useful predictor of student achievement compared to instructional expense percentages in Ohio. The current study is consistent with previous studies.

It was also hypothesized that an association would exist between district population density and school district proficiency percentages regarding math proficiency in third grade, where stronger associations would be present in suburban school districts in comparison to rural and urban school districts in Pennsylvania. A significant difference was not found between population density for math proficiency on the 1-way ANOVA or the Kruskal-Wallis test for the adjusted alpha level. This hypothesis was therefore rejected, contrary to differences found for reading proficiency.

The current findings for math proficiency were somewhat contradictory to research trends for population density. Multiple studies have suggested that students from high population density areas perform better on standardized achievement tests compared to rural areas (Borland & Howsen, 1999). Graham and Provost (2012) examined the relationship between population density and kindergarten mathematics achievement. The authors found that slightly higher achievement in mathematics for kindergartens in suburban schools compared to urban and rural counterparts. Additionally, achievement growth in mathematics from kindergarten to eighth grade were also higher in suburban students. Borland and Howsen (1999) examined student achievement from different population areas in Kentucky and found that third grade students from areas of moderate population density outperformed their rural and urban counterparts on both cognitive and academic achievement assessments. The authors concluded that policies should be aimed at improving access to resources across population domains to increase incentives for educational outcomes.

It was also hypothesized that school district interaction density would predict math proficiency, where school districts that had lower student teacher ratios would have higher math proficiency in third grade. A significant difference was not found between school district interaction density for math proficiency on the third grade PSSA. This hypothesis was therefore rejected.

The impact of student-teacher ratio on mathematics achievement is more limited in the literature compared to reading achievement. Tennessee Project Student-Teacher Achievement Ratio (STAR) found that smaller classes produced improvement in all areas of achievement, including math, when comparing class sizes of early elementary students (Nye et al., 1992). Contrarily, Akyuz and Berberoglu (2010) found a positive correlation between class size and mathematics achievement scores in their analysis of TIMMS data. The authors found that mathematics achievement increased along with the size of classes. Dunlevy and Heinecke (2007) examined the effectiveness of 1:1 computer-based interventions in mathematics and science for middle school students. No significant effects were found by the authors for mathematics achievement following the 1:1 laptop computer intervention.

It was also hypothesized that school district proficiency status would predict math proficiency, where school districts that had met AYP standards would have higher math proficiency in third grade. Proficiency status as measured by AYP status indicated a significant difference for math proficiency in third grade on the PSSA. This indicated that school districts that had made AYP the previous school year were likely to have higher proficiency rates in math the following year on the third grade PSSA.

The current study findings are consistent with literature trends regarding proficiency status and mathematics achievement. Jacob (2005) examined the impact of accountability policies mandating demonstrated AYP in mathematics achievement on state assessments in the Chicago Public Schools. The author found that mathematics achievement increased following the implementation of accountability policies when comparing performance data from before and after their enactment. Reback (2008) found that student achievement increased when their state assessment performance was particularly important to their school’s accountability rating. Ladd and Lauen (2010) analyzed student-level data from state assessments in North Carolina and found achievement gains for students below proficiency levels with higher effects in math compared to reading. Lauen and Gaddis (2012) found that accountability initiatives and increased academic standards in North Carolina benefitted students near grade level more than low or high achieving students in mathematics.

Research Question 3

Do any associations exist among the following variables: resources availability, population density, interaction density, and school district annual yearly progress status?

It was hypothesized that associations would exist between the following latent variables: resources availability, population density, interaction density, and school district proficiency status. Resource availability was measured by student expenditure by average daily membership as well as school district aid ratio market value/personal income. Population density was measured by the urban-centric code. Interaction density was measured by student teacher ratio. Finally, school district proficiency status was measured by AYP status. Spearman's Rho was utilized to explore associations between the latent variables. Because resource availability was analyzed by two separate metrics, two Spearman's Rho correlation matrices were analyzed: one as measured by student expenditure by average daily membership and the other by school district aid ratio market value/personal income. Additional Pearson parametric correlations as well as Kendall's Tau B non-parametric correlations were conducted to further analyze the relationships between the latent variables.

Small correlations were found between multiple latent variables when resource availability was observed by student expenditure. These included a small positive correlation between population density and interaction density (r=.28) as well as a small negative correlation between resource availability as measured by student expenditure and interaction density (r=-.38). These associations were consistent with the latent variable hypotheses. Small correlations were also found between multiple latent variables when resource availability was observed by aid ratio. These included a small positive correlation between population density and interaction density (r=.28) as well as a small negative correlations between resource availability as measured by aid ratio and population density (r=-.25) and proficiency status (r=-.21). These associations were again consistent with the latent variable hypotheses.

Minimal correlations were found between several of the latent variables when resource availability was observed by student expenditure using Pearson parametric correlation procedures. These included a small positive correlation between population density and proficiency status (r=.32) and interaction density and proficiency status (r=.32), as well as a small negative correlations between resource availability as measured by student expenditure and interaction density (r=-.34) and population density and interaction density (r=.-30). These associations were consistent with the latent variable hypotheses. Minimal correlations were again found between several of the latent variables when resource availability was observed by aid ratio using Pearson parametric correlation procedures. These included a small positive correlation between proficiency status and aid ratio (r=.21), population density (r=.32), and interaction density (r=.32), as well as a small negative correlations between population density and interaction density (r=-.30). These associations were again consistent with the latent variable hypotheses.

Finally, minimal correlations were found between several of the latent variables when resource availability was observed by student expenditure using Kendall's Tau B nonparametric correlation procedures. These included small negative correlations between resource availability as measured by student expenditure and interaction density (r=-.32) and population density and interaction density (r=.-24). These associations were consistent with the latent variable hypotheses. Minimal correlations were again found between several of the latent variables when resource availability was observed by aid ratio using Kendall's Tau B nonparametric correlation procedures. These included a small negative correlation between population density and interaction density (r=-.24). This association was again consistent with the latent variable hypotheses.

Interaction density was found to have small correlations with resource availability, population density, and/or proficiency status on several of the correlation matrices for this study. In particular, small correlations were present between interaction density and population density on the Spearman's Rho, Pearson parametric correlation, and Kendall's Tau B nonparametric correlation models, indicating this association was presented on all of the statistical correlation models. Literature explanations for these measured associations include theories regarding different economic factors and access to resources, value in the data obtained, and the effects of location in the value of obtaining an education (Borland & Howsen, 1999). Multiple studies, including Graham and Provost (2012) and Gottfried and Johnson (2014), have suggested that family socioeconomic status, parental involvement, social capital, and/or educational expectations may all be factors in associated student achievement outcomes. Ferguson (1991) found that student performance increased as funding was increased on instructionally critical resources in Texas school districts. These resources were defined by the author to included high-quality teachers, small class sizes, and curriculum supported by high-quality instructional materials. The small correlations between latent variables observed in the current study suggest that multiple factors may play a role in academic achievement outcomes. Further, attempting to equalize access to educational resources may increase student opportunities for learning (Darling-Hammond, 2013).

Limitations

Participants in this study included public school districts in the Commonwealth of Pennsylvania. Third grade proficiency rates in reading and math for four academic years were analyzed as outcome variables. History effects may be a threat to internal validity in this study. These effects include variance in school district calendars as well as variance in the school district daily schedules.

Pennsylvania school districts are required to provide 180 days of instruction (Romeo, 2014; PED, 1997). This regulation does not require a mandatory start date for the beginning of the school year for districts. Moreover, this regulation does not require uniformity of school holidays between school districts. Therefore, variance between school districts and instructional breaks due to school holidays and/or professional development was likely. Cultural differences may have also played a role in varying school district calendars, such as the observance of religious holidays as time off from instruction. Due to the physical size and geographical spread of school districts across the Commonwealth, the weather also impacted the calendar of school districts in different ways. The impact of inclement weather events such as snow, tropical storms, and/or hurricanes (i.e. Hurricane Sandy) may have also played a role between school district performances within and between school years analyzed for this study. In addition, the Pennsylvania Public Employee Relations Act (1970) established rights to public employees, including public school teachers, to permit labor strikes under limited conditions. Labor strikes are another factor that likely played a role in varying school calendars for school districts in the current study.

School districts in Pennsylvania are also required to provide no less than 900 hours of instruction per year for elementary students (Romeo, 2014; PDE, 1997). Again, this regulates the amount of instructional time school districts are required to provide per school year. However, this mandate does not require a specific breakdown of daily instructional time per subject. Therefore, school districts likely varied on the amount of instructional time per day. Additionally, differences in the amount of instructional time allotted per day in specific subject areas were also likely. Daily instructional time in the areas of language arts and mathematics in third grade were likely to differ and may have impacted school district performances on PSSA assessments between academic years.

Other factors between school districts may have also impacted the validity of the study findings. Many school districts utilized practice performance assessments to assist in preparation of PSSA assessments as well as possible predictors to performance. Examples include 4Sight assessments (Pennsylvania Training and Technical Assistance Network, 2010), Study Island assessments (Edmentum, 2015), and curriculum diagnostic tests (CDT) (PDE, 2016). The use of such assessments by some school districts may have had a practice effect on performance outcomes on the PSSA. The variance of use of such practice performance assessments for the school districts and years included in the study may have also impacted the validity of the findings.

An additional study limitation include other factors not examined may have influenced proficiency in reading and mathematics in third grade populations. School district curricular materials for teaching reading and mathematics standards in third grade likely differed between and possibly within the academic years included in this study, as there are no statewide curricular publications. Because each school district is able to choose its own curricular materials, this may have impacted reading and mathematics proficiency rates. Moreover, multiple teachers across school districts have taught third grade state curriculum standards in reading and mathematics between the 2009-2010 academic year and the 2012-2013 academic year. Attrition rates amongst third grade teachers in Pennsylvania school districts may have also had an indirect impact on proficiency rates across these academic years.

Study limitations also include threats to external validity. The data analyzed in this study only examined school district proficiency rates in reading and mathematics for third grade students in Pennsylvania. This may limit the generalizability of the results with other grade levels in the Commonwealth. The patterns between academic years in reading and mathematics may differ if other grade levels were to be examined in the future. Likewise, the generalizability is also limited to the Commonwealth of Pennsylvania, as the population examined only included the school districts in the state. The patterns between academic years in reading and mathematics may also differ if school district populations in other states were to be examined.

Implications for Practice

The study findings indicated a significant difference between short and long instructional years and proficiency rates in reading and mathematics on the third grade PSSA. However, the study found that school district proficiency rates in both reading and mathematics were higher for short instructional years compared to long instructional years included in the study. Therefore, the findings are somewhat contradictory to the assumption that increasing the quantity of instructional time would result in higher academic achievement in the areas of reading and mathematics. The time dedicated to instruction is frequently examined as a resource in the educational process (Baker et al., 2004). This assumption is evident in historical recommendations on national educational reforms that included recommendations for increasing instructional time, such as the National Commission on Educational Excellence (1983), the National Education Commission on Time and Learning (1994), the Center for America Progress (2005), and the Obama administration (Klein, 2009). Increasing learning time for low-performing students has been a talking point in policy discussions (Farban, Christie, Davis, Griffith, & Zinth, 2011). This belief has resulted in schools and educational policies attempting to maximize academic learning time (Aronson, Zimmerman, & Carlos, 1999). However, the current findings suggest limitations in the belief that increasing instructional time alone will result in achievement gains. Effective and meaningful use of time has been associated with achievement gains in schools compared to others from similar backgrounds (Chenoweth, 2007). Although instructional time is often considered an integral factor in educational outcomes, research has found limited and somewhat conflicting conclusions on its causal effect on later outcomes (Kikuchi, 2014). Long (2014) determined that the length of the school year had no effect on academic achievement and the specific uses of time in school had a stronger influence on effective instructional time and academic achievement. Joyner and Molina (2011) concluded that the amount of instructional time was not as important as how the actual time of instruction was spent. Baker et al. (2004) argued that instructional time is an educational resource that does not warrant as much policy attention as it has received. Recommendations to policymakers that resources should be used to improve teacher and curriculum initiatives as opposed to increasing instructional time at the national level were given as well as suggestions for increasing time on instruction for schools providing less instructional time were also provided.

The implications from the current study suggest that focusing on time spent on instruction alone is not a good predictor of achievement in reading and mathematics. As such, implications for educators in Pennsylvania include focusing on the efficacy and appropriateness of how instructional time is spent in schools versus focusing on an allotted amount of time. These include increasing active student engagement in the learning process, appropriately differentiated instructional practices matched to student performance levels, and student feedback through data-based practices to guide instruction. The use of such research-based instructional practices along with extended opportunities for learning together may be a more effective strategy for improving student achievement at the district level than focusing on time alone.

Recommendations for Future Research

Pennsylvania school districts performed better on the reading and mathematics PSSA assessments during the short instruction years compared to long instruction years in this study. Further research into the differences between the short and long instructional years examined would therefore be warranted. The instructional practices at the classroom level would be a particular area of research interest. The instructional practices of teachers as well as school districts may differ during years where PSSA assessments are earlier in the year. Differences may include instructional practices geared more at test-specific content and/or testing preparations during years where less time is perceived for PSSA preparation compared to years where more instructional time is allotted by the calendar. Further research into these specific practices may provide additional insight to the difference between proficiency rates in reading and mathematics during short and long instructional years.

Additionally, research regarding fatigue is warranted given the results of the current study. As proficiency rates were lower on PSSA assessments in reading and mathematics during long instructional years, it is possible that student fatigue may have played a role in the findings. Further research regarding the time of year in which achievement assessments are proctored along with perceptions of student fatigue is an area of research to follow the current findings. Rate of improvement trends explored by Kovaleski, VanDerHeyden, and Shapiro (2013) have indicated greater student growth in response to academic interventions in the fall compared to the spring. This, along with the findings of this study, indicate a need for further research to explore student fatigue pattern differences in the school calendar and its impact on achievement assessments. Additionally, teacher fatigue may have also played a role in the differences between short and long instructional years. Likewise, additional research on perceptions of teacher fatigue and the time of year high-stakes assessments take place may also provide insight into the current findings along with its own relationship with student achievement on standardized assessments.

Research regarding school district instructional practices is also relative to the current findings. The use of school district and grade-level data intervention teams and its relationship with student achievement on state assessments would provide further insight to the study findings. School districts use such teams to help guide instructional practices based upon data collection to help improve student achievement. Data collection is utilized to help support students at-risk for underachievement in reading and mathematics, including use of small-group interventions to increase achievement. Further research into specific curriculum-based assessments in identifying students in need of further intervention prior to the state assessments may be helpful for school districts in making purchase decisions for specific assessments as well as instructional materials, including those used for small-group interventions.

In addition, a follow-up study would be beneficial to compare Pennsylvania to other states that may administer assessments at a consistent date in the school year. This information would be beneficial for Pennsylvania to make revisions in the current administration procedures for the PSSA if other states are making more meaningful progress in comparison. Additional research could also be conducted in states with similar procedures to Pennsylvania's current practice in PSSA administration timelines, where further comparisons could be made specifically to reading and mathematics.

High-stakes state assessments are a hot topic issue not only in the Commonwealth of Pennsylvania, but throughout the United States. Consideration must be given to making testing accommodations and administration favorable for school districts as well as students taking the assessments. Although quantity of instruction in reading and mathematics is a factor to be considered for its impact on student achievement, it may not be as important of a factor compared to quality of instruction provided to students. Further research into measurable variables impacting quality and effectiveness of reading and mathematics instruction continues to be warranted.

Summary

The results of this research study indicated a significant difference between short and long instruction years on reading and mathematics proficiency rates on the third grade PSSA assessment. Higher proficiency rates were found for short instruction years compared to long instruction years in reading and mathematics. These results suggest that increasing instructional time did not result in higher achievement in reading and mathematics on the third grade PSSA assessment. This was contradictory to the study hypothesis. Resource availability as measured by aid ratio market value/personal income, population density, and school district proficiency status were also found to be a significant predictors of reading and math proficiency on the third grade PSSA. Small positive and negative correlations were also found between multiple latent variables through Spearman's Rho. Limitations to the study results include history effects, practice effects, and impact of outside factors as well as limiting the generalizability of the results to third grade in Pennsylvania school districts. Future research should focus on factors contributing to instructional quality and effectiveness impacting student achievement as well as comparing the performance of Pennsylvania school districts to other states which may administer state assessments on a consistent annual basis.

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