11-2016

Relationship Of Block Scheduling To Student Achievement And Learning Activities

Kevin C. Roberts Jr.
University of New England

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by

Kevin C. Roberts, Jr.

Bachelor of Science in Education (State University of New York, College at Cortland) 2001
Masters of Education (Virginia Commonwealth University) 2004

A DISSERTATION

Presented to the Affiliated Faculty of

The College of Graduate and Professional Studies at the University of New England

Submitted in Partial Fulfillment of Requirements

For the degree of Doctor of Education

Portland & Biddeford, Maine

November, 2016

Kevin C. Roberts, Jr.
November 18, 2016
Educational Leadership

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ABSTRACT

Increasingly over the last several decades, school districts turn to their schedules as tools to be leveraged to increase student achievement or to better deliver their educational program. Throughout the late 20th Century and early 21st Century, the exploration of the schedule as a tool for learning quickly turned to action as great movement was made to block scheduling from the traditional schedule. As quickly as action was taken to implement block scheduling, questions arose regarding its impact on student achievement. These questions have attempted to be addressed through a significant body of research conducted over the last twenty-five years. Unfortunately, the research findings are as discrepant today as they have ever been.

This study extends the ongoing research dialogue on this topic to include a focus on the impact of the school schedule on student achievement on the Pennsylvania Keystone Exams and on the level of rigorous learning experiences that students have in the correlating classrooms. Similar to the vast body of studies conducted previously, the goal was to note any significant differences in these two areas between block and traditionally scheduled schools. Achievement data was gathered for the six participating Pennsylvania high schools over three academic years. In addition, data regarding the level of rigor experienced by students in their classrooms was gathered through interviews with the building principals in the participating

schools. Schools were paired based on the similarity of their demographics and independent t-tests were conducted for the mean achievement data on each exam type. In addition, data regarding rigor was aggregated by schedule type and then an independent t-test was conducted to compare the mean rigor experienced in block or traditional classrooms as well.

This study concluded that schedule type did not yield a statistically significant difference in mean achievement scores or the level of rigor experienced by students. As a result, the researcher concluded that transformative leaders should continue to leverage the school schedule to best implement the educational program knowing that the schedule alone does not dramatically impact achievement or rigor for students.

University of New England

Doctor of Education
Educational Leadership

This dissertation was presented
by

Kevin C. Roberts, Jr.

November 18, 2016

Dr. Steven C. Moskowitz, Lead Advisor
University of New England

Dr. Tarae Waddell-Terry, Secondary Advisor

Mrs. Jeanne Temple, Affiliate Committee Member

ACKNOWLEDGEMENTS

I wish to thank my wife, Jennifer, for her love, support, and encouragement throughout this journey. Without her commitment to me and our family, this journey would not have been possible. She certainly is the "glue" that holds our great family together.

I wish to thank my three wonderful children, Kiley, Alaina, and Audrey. While they are young and may not have noticed the time commitment that this journey took leading to time away from them, I did. I am hopeful that the time investment yields a message to each of them to always work hard and finish what they start.

I wish to thank my parents, Kevin and Joanie, for their love and encouragement throughout my life. Their continued pushing for me to set and achieve lofty goals have shaped my character and commitment to hard work.

I wish to thank my dissertation committee, Dr. Steven Moskowitz, Dr. Tarae Waddell-Terry, and Mrs. Jeanne Temple. Each have provided tremendous guidance and support throughout this process. Embarking on a journey that is "to be defined" can be overwhelming, but their guidance and support has helped to make it extremely enjoyable.

Finally, I wish to thank Mr. Richard Fry. Without his leadership, guidance, and mentorship I may not have even started this journey. Thank you for seeing in me, what I didn't even know was there.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Leveraging the school schedule as a tool for learning has been a focal point in education since the early framers of public education developed the model nearly 150 years ago. The evolution to school schedules utilized today has been shaped by discussions, decisions, and publications such as the *Report of the Committee of Ten* (1894), National Education Association's *Cardinal Principles of Education* (1918) and vertical articulation of a standardized education through Carnegie Units by the Carnegie Commission in the early 20th Century.

The release of *A Nation at Risk: The Imperative for Education Reform* (1983), reinforced the conversations and urgency for significant change. The findings of the report included what was described in our nation's schools as a "homogenized and diluted curriculum", "poor management of classroom time", and deficiencies in the level of rigor experienced by the students as a result of their programming (The National Commission on Excellence in Education, p. 20-21). Two key recommendations driven by the report were an increase in the rigor of the coursework and a prioritization and reconfiguration of the way in which schools utilize their time to reduce interruptions in the learning environment. Reinvigorating the conversation, the National Education Commission on Time and Learning released their report titled, *Prisoners of Time* (1994). This report called for a fundamental change in the way schools are organized, primarily looking at extended learning blocks. As stated in the report, modifications to the schools' schedule were critical to match the great changes that were happening outside of school (p.11). The primary outcome of the study was that fundamental changes to the schedule of the school day could lead to constructive educational reform. It was proposed that through a

redefined school schedule, more time could be dedicated to student learning and professional development and less time would be taken for non-learning tasks (National Education Commission on Time and Learning, 1994, p. 19). These tasks can include additional transition time between classes and time taken for clerical tasks (taking attendance) that can be compounded with schedules that have shorter, additional class periods within one school day. This report sparked great dialogue and eventual decisions in many school districts across the country, leading to a change in many schools' daily schedules. Some of those schedule types that began receiving attention and utilization at this time included traditional scheduling, block scheduling, alternating block scheduling, and trimester scheduling (Canady and Rettig, 1995, p. 9).

While several derivatives of each exist, the two most prevalent forms of schedules utilized by schools include traditional and block. As implied by the name, the traditional schedule has been used historically by schools where the day is organized in a seven period day for approximately 50 minutes per period (Lorcher, 2012, para. 2.). Students maintain the same classes every school day for the entire school year. Within this model, teachers could interact with anywhere from 140 to 175 students per day, depending on class size. A block schedule extends the class period to approximately 80-90 minutes per class, but students either may not meet every day of the week or may only have classes for half of the school year (Lorcher, 2012, para. 3). Differences in this model from a traditional schedule include the engagement of students in fewer classes per day (five or fewer) and also fewer students on teachers' rosters at one time (80 to 125). Concerns regarding the level of achievement for students, as outlined previously, prompted significant movement toward block scheduling as a method of creating better learning systems and potentially, more personal learning communities (Duham, 2009,

p.37). As early as 2001, it was estimated that approximately fifty percent of the nation's high schools were utilizing some form of block scheduling (Gruber & Onwuegbuzie, 2001, p.33).

Today, schools continue to struggle with how best to organize their schedules to foster the greatest student academic achievement. Over the last twenty-five years, on time high school graduation rates have seen a less than modest improvement from approximately 74% in 1990 to approximately 81% in 2012 (National Center for Education Statistics, 2015). In addition, and directly connected to the meager increase in high school graduation rate, United States public school high school dropout rates remain relatively unchanged over that same time period. Approximately twelve percent of students dropped out in 1990, whereas approximately seven percent of students dropped out in 2013 (National Center for Educational Statistics, 2015). Unfortunately, the lack of significant progress continues in higher education where 33.7% of students graduated with their bachelor's degree in four years in 1996, where 39.4% of students completed their bachelor's requirements in four years in 2007 (National Center for Educational Statistics, 2014). The fallout from these compounding trends include increased remediation needed for students both at their respective high school and in higher education, a lack of employment skills necessary for gainful employment, and a significant earning gap over the course of this population's lifetime (Lynch, 2014, para. 5).

Along those lines, the United States Department of Education released a follow up report to *A Nation at Risk* titled *A Nation Accountable*, twenty-five years after the release of the initial report, summarizing progress. With regard to the level of rigor experienced by our students, it was noted that nearly one-third of our nation's high school graduates do not experience the level of rigor desired in the 1983 report (U.S. DOE, p. 3.). The way in which schools are structured for the utilization of time continued to be a concern in this update. It was noted that beyond

spending less time on academic subjects per week than other industrialized nations, that the utilization of our learning time is ineffective (p.6.). Lastly, achievement continued to be alarming as well. Six out of twenty fourth grade students born in 1983 were proficient in reading. Unfortunately, that number only rose to seven out of twenty fourth grade students born in 1997 demonstrating proficiency in reading as measured by the National Assessment of Educational Progress (p. 9).

As a result of less than adequate school improvement, schools continue to consider the schedule as a tool to be leveraged for optimal student success. A desire to address the achievement issues through extended learning blocks, or block scheduling, has been prompted by the notion that doing so provides for greater student focus on fewer classes, all while maximizing instructional time with fewer transitional interruptions (Cromwell, 2016, para. 9). School districts considering this type of change are in need of current and targeted research around pressing focus areas that are relevant. Other school districts may just need validation of their schedule as the best option for learning. Regardless of either position, continued study and focus on the topic is as critical now as it has ever been.

Problem Statement

Much promise has been placed in focusing on alterations in school schedule structures as a way to effectively institute school reform around teaching and learning, and also increase student achievement (Sturgis, 1995). Research conducted over the last two decades has demonstrated that the findings regarding the impact of block scheduling, or extended learning blocks, to student achievement are inconsistent (Mayers & Zepeda, 2006; Gruber & Onwuegbuzie, 2001; Ford, 2015). Positive effects of block scheduling on student achievement were noted in several of the studies reviewed (Biesinger, Crippen, & Muis, 2008, p. 192;

Hughes, 2004, p. 667). To the contrary, studies also report negative effects with block scheduling (Croninger, Rice, & Roellke, 2001, p. 606; Zelkowski, 2010, p. 12). These inconsistencies leave the original question of the impact of the schedule on student achievement relatively unanswered. This study adds to the dialogue on the impact of block scheduling on student achievement, by analyzing Pennsylvania Keystone Exam scores through a comparison of the mean achievement of demographically similar paired schools; one in a block schedule and one in a traditional schedule. This comparison was conducted for three paired school sets. In addition, information was gathered on the level of rigorous learning activities planned and delivered in applicable courses that are assessed by the Pennsylvania Keystone Exams. This lens was utilized as it may provide evidence of the impact of the schedule on instruction. Given the aforementioned inconsistencies in the findings regarding the impact of block scheduling on student achievement, research conducted on current standardized measures adds to this conversation. Beyond that, no current research exists on this topic utilizing the Pennsylvania high school standardized battery of assessments, the Keystone Exams. These exams include Algebra I, Biology, and Literature and are aligned to the new, nearly national set of academic standards known as Common Core Standards. This study provides for this expanded analysis not only on a Pennsylvania measure, but one that is current with recent standard expectations and also broadened to include three subject area assessments.

In addition, recent legislative changes have reinforced the demand for a return on investment necessary to generate student achievement and academic growth, necessitating informed decision making on effective school scheduling (Klein, 2015). The reauthorization of the Elementary and Secondary Education Act (ESEA), now titled the Every Student Succeeds Act (ESSA), clearly provides for state intervention and sanctions should student and school

achievement rates not reach defined standards (Klein, 2015). Beyond that, current research around this topic that also explores the level of rigor present in classrooms, in addition to academic achievement, is needed to move this dialogue forward. An understanding of the degree of classroom rigor can better complete the picture of whether or not schedule type impacts achievement and instruction. Mayers and Zepeda (2006) refer to a positive impact on these areas as "true reform" (p. 163) as a result of scheduling.

One significant promise of block scheduling was increased level of rigorous learning experiences as a result of longer periods leading to deeper lessons. Gill (2011) outlines that when provided with longer periods of time, the depth of a teacher's lesson and quality of instruction are better able to increase (p. 286). Beyond that, he asserts that active engagement in collaborative inquiry is better facilitated in extended learning blocks (p. 286). Unfortunately, Zelkowski (2010) further asserts that without continued professional development on how best to utilize extended learning blocks that instructional methods are reduced to traditional, lower level methods (p. 12). This study addresses the gap that exists in research by analyzing the level of rigor embedded in lessons in both types of scheduling models, block and traditional. Proponents of block scheduling cement their stance on benefits of block scheduling by outlining that the additional time provides for deeper, more rigorous learning experiences presented through more challenging lessons (Gabrieli, 2010, p. 43). On the contrary, Mayers and Zepeda (2006) found little evidence indicating that significant changes existed in the way in which teachers structured learning experiences for students in a block or traditional schedule. Additional research around this topic may help to indicate whether deeper learning experiences are constructed by teachers in a block schedule, as a result of having longer class periods, ultimately leading to more rigorous student experiences.

Finally, school leaders today need to engage in transformative leadership behaviors to bring about meaningful change for the betterment of their students and society. Shields (2010) calls for transformative leaders to engage themselves and others in activities that can create deep and equitable change (p. 576). Utilizing the school day, year, and experiences of our students can effect this deep and equitable change. Unfortunately, throughout generations of education, our students have experienced achievement gaps with regard to standardized assessments, an information divide for those having access to digital devices and the internet versus those that do not, and now as a result of the previous two types of barriers to equity our students experience opportunity gaps (Corso, Fox, & Quaglia, 2010). Effectively leveraging the school schedule to bridge these gaps provides today's school leaders with great opportunity to effect deep and equitable change.

Purpose

The purpose of this mixed-methods study was to examine the relationship of both block and traditional scheduling to student achievement and the level of rigor observed in classrooms for each schedule structure. The framework utilized to analyze classroom rigor was Webb's Depth of Knowledge. This framework, developed by Norman Webb, "relates more closely to the depth of content understanding and scope of a learning activity, which manifests in the skills required to complete the task from inception to finale (e.g., planning, researching, drawing conclusions)" (Carlock, Hess, Jones & Walkup, 2009, p. 4). Through this study, the framework and inherent four levels of learning, aided the researcher and participant in their coding of learning activities that were structured in lesson plans and also observed in classrooms.

The mixed methods study was completed utilizing a sequential explanatory strategy placing the quantitative component first, followed by the qualitative data. The primary purpose

of this method selection was to gather quantitative data (academic achievement) and then attempt to further explain the data with detail gathered in interviews (level of rigor prevalent in classrooms). Through this method, relatively equal priority was given to both data sets and the strengths include distinct stages and a relatively direct method to completing the study (Terrell, 2012, p. 262). This study was concentrated at the high school level, grades 9-12, and focused on schools within the Commonwealth of Pennsylvania. Ultimately, the findings presented included a determination of whether or not schedule type demonstrated impact on student achievement and classroom rigor. This information, coupled with the existing body of research, will help inform practitioners and school leaders when deciding a schedule to best support student success.

Research Questions

The research question guiding the study was

1. How do block and traditional school mean performances compare on the Pennsylvania Keystone Exams?
2. How does the frequency of rigorous learning activities that students experience in Pennsylvania Keystone Exam tested courses compare in a block versus traditional schedule?

A non-directional null hypothesis was tested for the first research question. It was tested that no significant difference will exist in the academic achievement of the students on the standardized assessments in a block or traditional schedule. The first question yielded three separate null hypotheses that were tested:

1. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the

population Algebra I test mean for block schedule schools and u_2 = the population Algebra I test mean for traditional schedule schools).

2. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Biology test mean for block schedule schools and u_2 = the population Biology test mean for traditional schedule schools).
3. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Literature test mean for block schedule schools and u_2 = the population Literature test mean for traditional schedule schools).

A non-directional null hypothesis was tested for second research question as well. It was tested that no significant difference will exist in the mean level of Webb's Depth of Knowledge in the Keystone Exam assessed courses in block or traditional schedules. The null hypothesis that was tested was:

1. The mean level of Webb's Depth of Knowledge Level Three will not be significantly different in block scheduled courses than traditional scheduled courses ($H_a = u_1-u_2=0$, where u_1 = the mean level of Webb's Depth of Knowledge in block scheduled schools and u_2 = the mean level of Webb's Depth of Knowledge in traditional schedule schools).

Additional detail will be provided in Chapter 3: Methodology.

Conceptual Framework

Directly addressing the school schedule provided an opportunity for school reformers to capitalize on the underpinnings of the Constructivist Theory. Constructivist Theory or

constructivism posits that learning is not linear and is a process by which the learner constructs their knowledge through interaction with content, experiences, and others. (College of Education, University of Houston, n.d., para. 6). A change in the school schedule offers potential for real reform to capitalize on these core tenets of constructivism. A block schedule could provide for extended learning periods leading to greater interaction and fewer interruptions. As stated by Canady and Rettig (1995), "Students traveling through a six-, seven-, or eight-period day encounter the same number of pieces of unconnected curriculum each day, with little opportunity for in-depth study" (p.4). Block scheduling could help mitigate this issue and facilitate deeper learning opportunities where students interact more and construct their learning.

Despite inconsistent research findings on the impact of block scheduling over the last twenty five years (Mayers & Zepeda, 2006; Gruber & Onwuegbuzie, 2001; Ford 2015), the research has also provided concrete direction for future study. First, historical studies have demonstrated the need for future research to utilize standardized assessment data when determining effect (Hughes, 2004; Gruber & Onwuegbuzie, 2001; Bottge, Gugerty, Moon, & Serlin, 2003). Hughes (2004) addresses this specifically by stating that using grades rather than standardized assessments opens up questions of subjectivity. He asserts that the subjectivity of grades can cast fairly significant doubt on the actual or real achievement of students (p. 665). Next, existing research has called for current studies to be conducted on this topic around current assessments. Mayers and Zepeda (2006) state that "stakeholders need research that reports a sufficient amount of data, collected over time, to enable informed conclusions to be drawn" (p. 163). Current research helps to build off of the existing body of research to provide for a more robust data set. Lastly, while not overtly communicated in findings, the inconsistent nature of

the findings encourages one to complement the focus on achievement with a focus on prevalent learning activities in each school structure. Dexter, Maltese, Sadler, and Tai (2007), reinforce this focus in their study outlining that the "frequencies in teaching methods reported by students in traditional and both block scheduling plans are strikingly similar" (p. 3). This could demonstrate that the types of learning activities students are engaged in could have a bigger impact on learning than a specific schedule type. More directly connected to their research, their findings also demonstrated that despite the schedule type, teaching methods remained very similar.

To capitalize on the existing body of research, personal experiences with various scheduling types, and the constructivist theory, this research was structured to focus on the aforementioned research questions targeting a comparison of student academic achievement as measured through the Pennsylvania Keystone Exams of Algebra I, Biology, and Literature. In addition, information was gathered focusing on the prevalence of planned rigorous learning activities in classrooms in both block and traditionally scheduled schools.

Assumptions, Limitations, and Scope

The framework for this study was based on two inherent assumptions. One assumption that helped to provide motivation for the study was the philosophy that the school organization, and more specifically school scheduling, has potential for impact on the successful delivery of the program. That impact could include a variety of effects including effective student scheduling, delivery of a well-balanced program, or for the purposes of this study, a potential impact on academic achievement and rigor experienced. Another assumption was that school leaders view the schedule as meaningful mechanism to be leveraged for student success.

This study is also limited by several factors. First, student learning, and thus academic achievement, is impacted by many factors with the school schedule potentially being just one. Due to that, the results of the study may indicate impact or lack of impact, but should not be interpreted as direct causality. Next, the focus of this study was on a single assessment type, the Pennsylvania Keystone Exams. While the impact was analyzed through achievement on three exam types (Algebra I, Biology, and Literature), the assessment type is still singular; the Pennsylvania Keystone Exams. As a result, findings may not reasonably be generalized to other modes of standardized testing such as Advanced Placement (AP) testing or the Scholastic Aptitude Test (SAT), as examples. Finally, information gathered from school leaders regarding the level of instructional activities that are planned and observed in applicable courses for this study relies on a limited number of lesson plans and administrator observations, and thus, a limited number of teachers. Not only could the data gathered be impacted by the size of the participant group, but the method of analyzing the level of rigor in the assessments is reliant upon the understanding of Webb's Depth of Knowledge and the collaborative coding of rigor on this framework by the researcher and the building principal.

As for the scope of this study, the research was focused at the high school level in schools within the Commonwealth of Pennsylvania. Beyond that and for ease of access to the schools, priority was given to schools within close proximity to South Central Pennsylvania. Standardized assessment data was gathered via Pennsylvania's data warehouse, eMetric, that included academic achievement on three Pennsylvania Keystone Exams; Algebra I, Biology, and Literature.

A final limitation for this study could have been the researcher's experiences with block scheduling at his place of employment. Block scheduling has been utilized in the school district

for approximately fourteen years. Given the longstanding use of this method of scheduling at that school district, the researcher was aware of several seemingly positive and negative attributes of block scheduling at the location. The researcher needed to minimize the impact of this potential bias by utilizing member checks and unbiased statistical analyses of standardized assessments.

Significance

This study bears great significance for a variety of reasons. First, the study helps to contribute to the ongoing dialogue among researchers on the topic of school scheduling impact. To date, significant time and effort has been placed on this topic with a focus on student achievement with regard to GPA and select standardized assessments. Broadening the focus to include additional current standardized assessments and an analyses of the level of rigor planned for within each schedule model will further the discussion as recommended by other researchers (Zelkowski, 2010).

This study also has significance given the current educational landscape both within the Commonwealth of Pennsylvania and to school districts across the nation as well. Despite the continued inclusion of sanctions for inadequate performance, the reauthorization of the Elementary and Secondary Education Act (ESEA), now titled the Every Student Succeeds Act (ESSA), provides school districts and school leaders with much greater flexibility to build systems that yield the greatest results for our students (Klein, 2015, para. 9). Through this legislation, states and districts receive tremendous flexibility in the establishment of goals, building of accountability systems, and providing for corrective action to underperforming schools (Klein, 2015, para. 8). Under the former legislation, school districts were held accountable by a system of Adequate Yearly Progress (AYP). This AYP structure measured

schools by defined incremental gains in student academic achievement. Ultimately, AYP, as prescribed through the *No Child Left Behind Act of 2001*, defined benchmarks for schools to meet in order to have all students proficient in reading and mathematics by 2014 (Education Week, 2001, para. 2). A potential unintended result of this incrementally increasing accountability was the stifling of school leaders to innovate and attempt brave measures to greatly impact student learning. Within the former system, a shift to a different type of school schedule could be seen as overly dramatic and a potentially less than desirable option given its risk. School leaders may have decided to safely maintain their current schedule in an effort to meet the minimal, incremental gains. With the flexibility in ESSA, school districts are no longer required to meet AYP, but instead state defined targets that are less discrete, providing for greater flexibility in bold leadership decisions. The information gained from this research can serve leaders well that may be contemplating a rather aggressive schedule change.

Next, in 2014 the Commonwealth of Pennsylvania amended and adopted Chapter IV of the Pennsylvania Code. Chapter IV articulates requirements of districts in the state for academic standards, assessments, and ultimately graduation requirements. This amendment encompassed the inclusion of the Keystone Exams as a standardized assessment measure, greater flexibility for the number of Carnegie units necessary for graduation, and adoption of the Pennsylvania Core Standards as the academic standards for the state (PA Code – Chapter IV, 2014). As stated previously, this revised legislation provided for greater flexibility for school districts, especially when considering scheduling and standardized assessments. The previous legislation utilized an end of year assessment, called the Pennsylvania System of School Assessment (PSSA). Given that the assessment was administered only near the end of the school year, most school districts embraced a traditional schedule as a structure to best prepare the students for this assessment,

since the end of the course coincided with the end of year assessment. The incorporation of the Keystone Exams as Pennsylvania's standardized assessments also included an additional assessment window at the midyear point to better serve districts utilizing a block schedule. This change in the assessment system and flexibility granted through the amendment of Chapter IV, now make block scheduling a much more desirable option than it had once been in Pennsylvania.

With the increased flexibility granted, whether it is through ESSA or amendments to Chapter IV in Pennsylvania, school leaders are better enabled to leverage the schedule to transformatively address student needs (PSBA, 2014, para. 7). The limitations that had once existed with scheduling by the timing of the administration of standardized assessments have dramatically decreased. In addition, flexibility with graduation requirements now enable schools to provide for more opportunities for internships and other relevant experiences for students within their high school years. A schedule that helps students reach proficiency on required standardized assessments more quickly can facilitate greater opportunities for these flexible and relevant offerings for students. (PSBA, 2014, para. 6) In total, this creates greater urgency now for school leaders to closely evaluate the effect of their school schedule on student achievement and student growth.

Finally, an understanding of the potential impact on rigorous learning experiences for students as a result of a schedule type is valuable information in general. School leaders would benefit from information that potentially indicates if one schedule type or the length of a course or class period yields better opportunities for deeper construction of knowledge for students. Proponents of block scheduling assert that longer class periods provide for greater opportunities for deeper, more meaningful learning (Canady and Rettig, 1995). This study will help to determine if this assertion is in fact realized through the subjects of this study. Again, this

information is valuable to transformative leaders aspiring to provide the richest learning experiences for students, potentially impacting the rest of their young lives.

Definition of Key Terms

For the purpose of this study, the following terms are defined.

Academic Achievement – The outcome of education as measured for this research through student proficiency scores on three Pennsylvania Keystone Exams; Algebra I, Biology and Literature. Pennsylvania has four levels of proficiency on the standardized assessments including Advanced, Proficient, Basic, and Below Basic. "Proficient" scores are scores falling in the Proficient or Advanced achievement levels.

Academic Growth – A student's progress as measured by the change in their achievement from one assessment point to another utilizing the Pennsylvania Value Added Assessment System (Pennsylvania Department of Education, PVAAS, 2016, para. 3).

Block Schedule - Typical block schedules are structured as a four by four block, often referred to as the Copernican block schedule. This structure provides students with four classes per semester and the class periods are generally 90 minutes in length. (Cromwell, 2016, para. 4)

Keystone Exam - Keystone Exams are Pennsylvania end-of-course standardized assessments designed to evaluate proficiency in academic content including Algebra I, Biology, and Literature. These exams are administered following completion of the applicable course, most typically at the high school level (Pennsylvania Department of Education, 2013, para. 1).

Traditional Schedule - A traditional schedule is typically defined as a seven-period schedule where each of the seven classes meet daily for the duration of the school year. Each class period ranges from an average of 45 to 55 minutes in length (Cromwell, 2016, para. 5).

Transformative Leadership – A distinct leadership theory where the leadership is "grounded in an activist agenda, one that combines a rights based theory that every individual is entitled to be treated with dignity, respect, and absolute regard with a social justice theory of ethics that takes these rights to a societal level" (Shields, 2010, p. 571). In this theory, leaders leverage their positional platform to pursue social equity and justice.

Webb's Depth of Knowledge – A framework developed by Norman Webb that "relates more closely to the depth of content understanding and scope of a learning activity, which manifests in the skills required to complete the task from inception to finale (e.g., planning, researching, drawing conclusions)" (Carlock, Hess, Jones & Walkup, 2009, p. 4).

Conclusion

While research to date has been marked by inconsistencies of benefits and costs to the various forms of scheduling, one certainty is that the way in which the school day is structured impacts the experiences that students have at school. The question of superiority of impact on student achievement between block and traditional scheduling remains relatively unanswered despite the vast amount research conducted over the last twenty-five years. Through the analysis of a body of relevant research studies, it is clear that the focus and construct of the research, along with the context of the study can provide great information for practitioners and school leaders. Naturally, the similarities between the study and the practitioner's specific situation and how recent the study is play important roles in the value of the findings to practitioners. Hence, this study, focusing on the impact of block scheduling to student academic achievement as evidenced through objective standardized assessments, helps to present meaningful findings to practitioners today. The additional lens of moving beyond assessment to understanding the prevalence of rigorous planned and delivered learning activities provides another dimension to

this dialogue as well. Given the educational landscape of today's schools and the hypersensitivity of measuring each aspect of the educational process, a current study in this area could prove beneficial to stakeholders and key decision makers.

The following chapter will provide an overview of relevant literature and previous research studies regarding the impact of block or traditional schedules. The body of research and literature has shaped this study directly through the theoretical framework and research methods.

CHAPTER 2

REVIEW OF THE LITERATURE

The structure and schedule of the school day and year has remained a focus for school stakeholders over the course of the last 125 years (Mayers and Zepeda, 2006). Much promise has been placed in focusing on alterations in these school structures as a way to effectively institute school reform to positively affect student achievement (Gabrieli, 2010, p. 40). Whether the focus was standardization of the school experience with *The Committee of Ten* (Mackenzie, 1894) or leveraging the length of the day and class period for better learning through the report titled *Prisoners of Time* (1994), there has been a longstanding focus on utilizing the schedule most effectively to impact learning. The most significant changes in the school structure have included the lengthening of the school year and the school day, as well as the structure of the school schedule. Focusing specifically on the structure of the school schedule, much time and energy with research has centered on the purpose and effect of extended learning blocks, called block scheduling.

The block schedule promised greater opportunities for varied instructional approaches, reduced administrative functions within the day, fewer classes for students to focus on at one time, and greater opportunity for students to engage in elective offerings (David, 2006, p.252). In addition, and highly debated, was the claim that block scheduling could lead to greater student achievement. As stated in *Prisoners of Time* (1994), "New uses of time should ensure that schools rely much less on the 51-minute period, after which teachers and students drop everything to rush off to the next class. Block scheduling – the use of two or more periods for extended exploration of complex topics or for science laboratories – should become more common" (p. 31). Furthermore, adhering to a schedule of extended learning blocks would lead

to students "meeting high performance standards in key subjects" and not maintaining the school focus of students merely getting "seat time or Carnegie units" (p. 31).

This chapter is designed to focus on: 1) School Reform, 2) Traditional Scheduling Models, 3) Block Scheduling and Academic Achievement, and 4) Block Scheduling and Instructional Practices. When reviewing the research conducted over the last two decades (Arnold, 2002; Abbott, Baker, Clay, and Joireman, 2007; Cobb, Dugan, Lewis, and Winokur, 2005; Biesinger, Crippen, & Muis, 2008), it is evident that studies vary in focus and findings, when looking at the impact of block scheduling to achievement. In an effort to maintain objectivity when looking at research studies, those included in this review focused on measuring student achievement through standardized assessment measures. Some studies measured student achievement through each student's grade point average (GPA). However, validity can be questioned using GPAs as grading practices are not standardized. As stated by Hughes (2004), "The choice of GPA as an indicator of scholastic performance may not be the best measure to employ. Perhaps some standardized test scores…might be a better measure of the academic achievement" (p. 667). As a result, studies using GPAs solely were discarded and the focus of this review became those utilizing standardized assessments as the primary metric of student achievement.

Literature was targeted through keyword searches focusing on keywords such as: block scheduling, extended learning blocks, achievement, alternative scheduling, and scheduling. These keyword searches were conducted primarily in ERIC – EBSCO, HeinOline, LexisNexis Academic Universe, and Google Scholar. Beyond that, several books on extended learning blocks and block scheduling were reviewed as well.

School Reform and the Continued Urgency for Change

In the late 1800's, a committee was established to help set recommendations for the standardization of public education, titled *The Committee of Ten*. At that time, the school outcomes, curriculum, and focus were set entirely by the locality, and even individual teachers, leading to great inconsistencies in the level of achievement realized by the students. As noted in the Committee's report, a better standardization of the high school experience was needed given the lack of readiness of high school graduates for higher education (Mackenzie, 1894, p. 148). The committee set expectations for teacher preparation, the length of the school year, and the length of time spent on certain courses of study (p. 150). While significant focus was set on readiness for college, it was clearly noted that the same academic expectation for college bound students should exist for those experiencing the high school program as a terminal function (p. 148).

Complementing this move to standardization of the higher education and high school experience was Andrew Carnegie's work on a pension system. In 1906, Carnegie worked to develop a pension system to benefit college professors (Silva, Toch, & White, 2015, p. 7). In order for professors to qualify for this pension, colleges and universities had to standardize around time spent teaching. Thus, the Carnegie Unit was developed for courses as 120 hours of instruction over 24 weeks (p. 8). This standard equated to one hour of instruction per day for each of the 24 weeks. Again, this method of standardization of instructional time helped to establish consistency for those eligible for the Carnegie pension program. The Carnegie Unit quickly became the currency for education and this standard was then generalized to public high schools as well. Credit was established and awarded to students that completed 120 hours of instruction in each course over the school year (p. 10). Considering that the length of the school

year was generally 180 days, or 36 weeks, for most high schools the standard class period was established at anywhere from 45-55 minutes per day to comply with the 120 hour course standard. This quickly became the birth of what is known as a traditional schedule.

Moving forward, 1918 brought about a National Education Association commissioning of a committee titled, *The Commission on the Reorganization of Secondary Education*. This committee focused on establishing common, interconnected goals for secondary education. The impetus for the work and the subsequent recommendations were the lack of a minimum target set for all students within the United States. The primary concern was that the national education system was not adequately preparing students for successful entrance into higher education, the workforce, or for successful democratic citizenry (National Education Association, 1918, p. 9).

The first two school reform efforts were driven internally by our nation through committees established for the betterment of our national education system. While the work was prompted by a lack of satisfaction with the current educational system, the commencement of the work was triggered by those internal to the system. In 1957, the Soviet Union launched Sputnik amid the "Space Race" between the United States and the Soviet Union. This launch triggered educational reform efforts with a specific focus on mathematics, science, and engineering (Powell, 2007, para. 2). Not only was this driven by the desire for international educational prowess, but also national security. Several key priorities resulted from the challenge of this era. Most notably, authentic, hands on learning received greater educational focus and were realized through science and technology laboratory experiences (Powell, 2007, para 5). This push, both for more collaborative hands on experiences and an increase in laboratory experiences provided for a challenge under the current model of traditional scheduling. Completing activities like those inherent in laboratory experiences or other hands on experiences requires extended time.

This is often difficult to achieve under the relative constraints of a traditional schedule model (Gabrieli, 2010, p. 43). This challenge to provide the experiences in a fixed schedule with shorter periods, created more of an urgency to modify schedules to fit the learning, rather than modifying the learning to fit the schedule.

In 1983, the National Commission on Excellence in Education, chartered by President Ronald Regan, released a report titled, *A Nation at Risk*. This commission was established to address the growing concern over the lackluster American education system (A Nation at Risk, 1983, p. 7). As stated in the report, "the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people" (p. 9). The report summarized either stagnant or declining academic performance by American students on both standardized assessments and on other educational outcomes such as functional adult literacy (A Nation at Risk, 1983, p. 11). The report concluded with significant findings stimulating a strong call for reform. Two primary areas noted were the use of extended learning blocks for deeper learning and the need to provide for more rigorous classroom lessons and courses (A Nation at Risk, 1983, p. 21-23). This report triggered great emotion, reinforced a national focus on education, and led to a more significant focus on the length and quality of student learning blocks.

The mid 1990's brought about no shortage of information and legislation calling for significant change in education. President Bill Clinton signed Goals 2000: The Educate America Act into law in 1994. Within the set of eight goals, two primary goals included increasing the national high school graduation rate to 90% by the year 2000; and all students leaving grades 4, 8, and 12 demonstrating competency over challenging subject matter (Goals 2000, para. 4). The same year this legislation was signed into law, the National Commission on Time and Learning

released their report titled, *Prisoners of Time.* This report directly criticized the way in which schools are utilizing the school schedule or school day and the negative impact it had on student achievement. The report was framed around five fundamental issues with the existing school structures. Those issues included the assumption that students arrive at school ready to learn, the notion that taking time from class periods for non-instructional tasks has no impact on learning, that the existing school schedule and calendar met the demands of the current society, that school reform can happen in the absence of time to make the transformation, and that the current schedule and structure could deliver a world class education (p. 6-7).

This report called for elimination of the seven period per day, 51 minute period to a system of extended learning blocks (p. 31). The utilization of extended learning blocks provides for increased opportunities of collaborative learning between the students and teachers, greater differentiation for all learners, and less interruptions throughout the day caused by non-instructional tasks (change of classes, taking of attendance, fully transitioning students into the learning environment, etc.). The report outlines that heightened expectations are critically important for our schools, but that realizing those expectations is only possible when schools see "time as an elastic resource" that should be leveraged for optimal student learning (p. 44).

As a result of the promises of extended learning blocks and the political push by the aforementioned publications for change, a significant number of schools moved to some form of block scheduling as a method to positively impact student achievement. As an example of this shift and as documented by the North Carolina Department of Public Instruction, in the 1992-1993 school year, approximately 2% of North Carolina Public Schools utilized a block schedule. By the 1996-1997 school year, that number had grown to nearly 65% (1997 Survey Results,

para.2). This relatively dramatic increase not only demonstrated greater interest in block scheduling, but also greater actual movement by schools to a block schedule.

Unfortunately, despite the continued interest and actual movement toward different methods of scheduling, student achievement was not dramatically impacted. As reported by the National Assessment of Education Progress in 2002, fourth grade reading scores were not found to be significantly different than those recorded in 1992. In addition, twelfth grade reading scores showed a continual decline from 1992 across all score distributions (National Center for Educational Statistics, 2003, xii). As a continuation of the concern over global competition, George W. Bush took steps in 2002 to address the urgency for school reform through legislation that he signed titled the *No Child Left Behind (NCLB) Act*. The requirements of NCLB included increased assessments for students in grades 3-8, the reporting of proficiency levels for subgroups of students at a much more detailed level than ever before, and a standard of having all students meet proficiency on state standardized assessments by 2014 (Klein, 2015, para. 6). To meet this ultimate threshold of total proficiency, a mechanism was structured in the legislation called adequate yearly progress (AYP). AYP mapped out incremental gains that needed to be met in order for schools and districts to follow an appropriate trajectory toward the aforementioned 2014 proficiency standard (para. 23). In addition to the expectations set in the legislation for proficiency, accountability for achievement was also well outlined including sanctions should schools or districts not meet AYP. These sanctions included anything from schools or districts being placed on a publicized warning lists, to corrective action plans, to total school take overs and dismissal of staff (para. 30).

In 2008, the United States Department of Education released a follow-up to *A Nation at Risk* called *A Nation Accountable.* This reports purpose was to outline progress made in the

twenty-five years following the release of *A Nation at Risk*. Despite clearly articulated and substantiated need for improvement in student academic achievement, this report noted that little improvement had resulted over the twenty-five year time period. It was noted that NCLB could provide for greater transparency of school achievement to help leaders act more swiftly and accurately when making decisions to impact learning (U.S. Department of Education, 2008, p.1). Despite this benefit, it was noted that schools, districts, and our national educational system was at even greater risk of failure in 2008 than it was in 1998 (p. 1). The report clearly outlined continued issues with school curriculum noting that easy courses were hiding behind misleading and "inflated" course titles (p. 4). Despite the deceptive nomenclature, the lack of rigorous high school curriculum continued to be a pressing issue. Finally, a continued pressing concern from this report was time. It was noted that time dedicated to academics during the school day did increase from 1983 (p. 6). Despite that, there was a direct call in the report to continue to examine the school schedule to maximize the effect of the time dedicated to learning (p. 6).

Over the course of 20th and 21st Century, a significant number of events and reports demonstrating a lack of student achievement in the nation's schools have led to reform. The reform has included modifications to many components of education, but one reform effort that continues to offer promise, but yields inconsistent results is the model of scheduling used by schools. Whether the schedule was modified to provide academic consistency, as in the case of the Carnegie unit, or to allow for greater laboratory or hands on learning experiences, like those changes following the launch of Sputnik, the continued need for better results in schools continues to exist. Unfortunately, both models of scheduling continue to provide uneven results, requiring more research for better informed decisions (Education Commission of the States, 2010). Given that the number of schools across the nation subscribing to some model of block

scheduling has reached approximately fifty percent, the demand for this research only continues to grow (Dexter, Maltese, Tai, & Sadler, 2007).

Conceptual Framework

Directly addressing the school schedule provided an opportunity for school reformers to capitalize on the key underpinnings of the Constructivist Theory. Constructivist Theory or constructivism posits that learning is not linear and is a process by which the learner constructs their knowledge through interaction with content, experiences, and others. One of the early fathers of the Constructivist Theory, Jean Piaget, rooted the theory in two key principles. He asserted that learning is an active process where the learner constructs the knowledge. Secondly, learning should be authentic and real to students (College of Education, University of Houston, n.d., para. 6).

Lev Vygotsky's contributions to this theory are best known through the theory of social constructivism. Vygotsky believed that "learning and development is a collaborative activity and that children are cognitively developed in the context of socialization and education" (Ozer, 2004, para. 10). Ozer (2004) goes on to state that a Vygotskian classroom "stresses assisted discovery through teacher-student and student-student interaction" (para. 12). Vygotsky's theory of social constructivism further enhances his notion of the zone of proximal development. The zone of proximal development outlines that a learner can perform or achieve in a certain range based on their age or developmental level. Despite that defined zone, the enhancement of a learning environment, rich with interaction, can assist learners in comprehending more challenging concepts through the support of interaction (Ozer, 2004, para. 11).

As stated by Chudy, Juvova, Kvintova, Neumeister, and Plischke (2015), constructivist theory in education focuses on "stimulating learners to interactivity, social communication and to

the development of their own knowledge, structures of knowledge and to the critical assessment of information" (p. 346). Chudy et al. (2015) go on to state that constructivist learning environments adhere to several key principles including:

- "emphasis on activity and increasing student's motivation for learning
- systematic approach to problem solving, finding connections, associations, interdisciplinary transfer
- maintaining the principle of continuity
- mutual communication between the teacher and student
- preparation for teamwork" (p. 347).

A change in the school schedule offered potential for real reform to capitalize on these core tenets of constructivism. Beyond merely providing students with fewer classes at one time and less time transitioning from class to class within the school day, block scheduling provides students with longer class periods where teachers can engage students more deeply in content and meaningful experiences (Biesinger, Crippen, Muis, 2008, p. 192). Facilitation of more authentic collaborative learning experiences such as laboratories, group work, and problem based learning could potentially provide great benefit to the students' experiences and achievement (Biesinger, Crippen, Muis, 2008, p. 192). If in fact a longer block period provides for these rich opportunities, a standardized assessment score comparison among three assessment types (Algebra I, Biology, and Literature) coupled with sets of administrator interviews to determine the level of rigorous learning activities prevalent in both types of class periods would provide key information on the potential benefit of a block schedule on both achievement and instructional practices, hence, the purpose of this study.

Schedule Types and Characteristics

With the establishment of the Carnegie Unit as the standard for education, the traditional schedule quickly became the model subscribed to for scheduling in public schools (Silva, Toch, & White, 2015, p. 7). Over the course of the last century and through the prompting of education leaders and politicians for school reform, several derivatives of school schedules have been developed to yield extended learning blocks. Canady and Rettig (1995) outline five types of schedules that exist in America's schools including the traditional seven or eight-period day, traditional six-period day, 4x4 block, alternating block, and modified block. Despite the variety of schedules, they note that two primary schedule themes exist. Those schedules include traditional seven or eight period schedules and block schedules. Below, each schedule type is defined and common characteristics are listed.

Traditional.

A traditional schedule is typically defined as a seven-period schedule where each of the seven classes meets daily for the duration of the school year. Each class period ranges from an average of 45 to 55 minutes in length over the course of the typical 180 day school year. This structure relies heavily on the standard set forth by Andrew Carnegie as the Carnegie Unit. The approximately 45 to 55 minutes per class, over the course of the entire school year provides for the Carnegie Unit of 120 hours of instruction per course. This structure includes students having the same set of courses for the entire school year. Teachers interact with approximately 140 to 175 students per day or per year depending on the class size. A sample student schedule is outlined in Table 1.

Table 1

Traditional Seven Period Schedule

Period	Class Title
Period 1	English II
Period 2	Geometry
Period 3	Introduction to Graphic Arts
Period 4	Band
Period 5	Biology
Period 6	United States Government
Period 7	Physical Education / Health

Advantages of traditional scheduling.

Several advantages exist for the traditional model of scheduling. When students maintain the same course load for the entire school year, with the same teachers, a sense of continuity and consistency can be established (Lorcher, 2012, para. 3). In addition, proponents of traditional scheduling see the shorter, 45-55 minute class periods as more conducive to the relatively brief attention span of a teen learner (para. 4). Students are able to more fully attend to the lessons without becoming oversaturated by content in an extended learning block of 75-100 minutes.

A traditional model of scheduling provides for approximately 22% more instructional time per year than a block scheduled class (Dexter, Maltese, Tai, & Sadler, 2007, p. 2). This reduction in class time with a block schedule can foster an increased pace of the class to ensure that curriculum is covered in the time given. Other researchers estimate that time difference between a block and traditional class to be nearly thirty instructional hours per school year (Algozinne, Eddy, & Queen, 1997, p. 108). Traditional schedules provide for consistency not only in the length of the classes taken each day, but in that students are enrolled in the same classes all year.

Beyond the consistency with enrollment in the same courses all year, curriculum continuity is better achieved for students when taking courses in a sequence (National Education Association, 2016, para. 4). A traditional schedule provides for courses taken in consecutive

order each school year. For example, a student may finish Spanish I in one school year and enroll in Spanish II for the very next school year. In a block schedule format, a student may take Spanish I in the fall semester of one school year and not have Spanish II until the spring semester of another school year. This represents a gap between courses of nearly one calendar year, whereas the gap between courses in a traditional model is only several summer months.

Block.

Block schedules are a direct derivative of the recommendations from the *Prisoner of Time* study calling for extended learning blocks (1994). Typical block schedules are structured as a four by four block, often referred to as the Copernican block schedule. This structure provides students with four classes per semester and the class periods are generally 90 minutes in length. This model of scheduling provides for longer class periods, with fewer classes taken per semester. Table 2 provides for a sample student schedule in this format.

Table 2
Block Schedule

Semester 1		Semester 2	
Period	Course	Period	Course
Period 1	English II	Period 1	Biology
Period 2	Geometry	Period 2	United States Government
Period 3	Introduction to Graphic Arts	Period 3	Physical Education / Health
Period 4	Band	Period 4	Personal Finance

Advantages of block scheduling.

Several advantages to block scheduling do exist. First, the number of courses that students and teachers have to focus on at one time is reduced, nearly in half. This provides students and teachers with the opportunity to have deeper, more direct contact given the greater length of the class period and the fewer number of student-teacher interactions needed per day.

Within a block schedule, teachers may have 80 to 105 students on their rosters, whereas in a traditional model of scheduling the teacher may see 140 to 175 students per day. These more rich interactions can lead to a community environment for the learners and the teacher (Gill, 2011, p. 288).

Another advantage of block scheduling is that the extended learning time can lead to deeper, more rigorous learning experiences (Gill, 2011, Fisher and Frey, 2007). With fewer classes and greater instructional time per class, students can be involved in more collaborative learning experiences, not as easily attainable in the shorter class periods. This benefit is one that was called for directly following the launch of Sputnik and the need for additional collaborative learning experiences and hands on laboratory experiences. Extended learning periods provide better for these learning experiences and reduce the number of interruptions per day, inherent in a traditional schedule (Canady and Rettig, 1995).

Along with the multiple classes that students have to focus on in a traditional schedule, each teacher has different standards and expectations as well. This model of scheduling places students in a position of having to adjust more times throughout a given school day for these varying standards than a block schedule ((National Education Association, 2016, para. 6). This coupled with the additional workload inherent in having to focus on two or three additional courses at one time can create a different learner experience for the student. In an attempt to reduce learner stress, block scheduling is seen as a desirable alternative. As reported by Flocco (2015), student academic stress is recorded as less in a block schedule than a traditional schedule due to such factors as mentioned above (p. 64).

Block Scheduling and Student Achievement

Considering that the currency for education is learning, school administrators and key decision makers are most interested in the impact of block scheduling on student achievement. In an effort to determine the impact of block scheduling and also provide a sound platform for schedule decisions, a relatively significant number of research studies focusing on the impact of block scheduling on student achievement have been conducted over the last twenty-five years. Mayers and Zepeda (2006) conducted a meta-analysis of 58 studies on the impact of block scheduling on student achievement. While the study was primarily focused on the impact of the schedule on achievement, it also analyzed the impact on instructional practices. The results clearly indicated that the body of research that exists demonstrates inconsistencies in the impact of both block scheduling on student achievement and block scheduling on instructional practices.

Positive Results.

Despite the inconsistencies in the research a significant body of research indicates a positive impact of block scheduling on student academic achievement. Cobb, Dugan, Lewis, and Winokur's (2005) longitudinal study found that block scheduling had a positive correlation on student achievement on the American College Testing (ACT) for Mathematics and Reading in eleventh grade students. In their findings, Cobb et al (2005) note that "Students from the 4x4 block scheduling group made impressive gains in reading as compared to the traditional group, with a very positive and very large effect size" (p. 82). They went on to state that for mathematics, "4x4 students again outperformed traditional students" (p.82). Even more important than the discovery of positive achievement was their statement on academic growth. The researchers found that "Not only did these students improve their mathematics achievement, but they outperformed both A/B and traditional students on the eleventh grade ACT test after trailing both groups on the ninth grade Levels test" (p. 83). While the comparative assessments

were two different standardized assessments, the researchers furthered the overall discrepant conversation on the impact of block scheduling to include a look at academic achievement and growth.

In addition to that study, Gill (2011) conducted a study measuring the impact of block scheduling on student academic achievement on a Virginia standardized assessment, titled the Standards of Learning (SOL). A positive impact was noted for students scheduled in a block format on the assessment and a particularly positive impact was noted for black and Hispanic students.

Negative Results.

Early in the life of the research around this topic, Arnold (2002) conducted research looking at the effect of block scheduling to student achievement as measured by eleventh grade test scores on the Tests of Achievement and Proficiency (TAP), a standardized state assessment in Virginia. The study analyzed results from 51 block scheduled schools and 104 traditionally scheduled schools over the course of three school years. The findings were that block scheduled students did not outperform their traditionally scheduled peers over this three year period. Arnold (2002) noted that the findings did "show that schools implementing A/B block scheduling can expect an increase in mean scale scores during the implementation year, but that an increase in mean scale scores may be negated during the subsequent years of block scheduling" (p. 52).

Through another study, Abbott, Baker, Clay, and Joireman (2007) conducted a study to determine the impact of block scheduling on student achievement when analyzing achievement on the Washington Assessment of Student Learning (WASL) found no positive effect of block scheduling to achievement (p. 13). It was determined on all subtests that while the block

schedule and traditional schedule students outperformed students scheduled in another model, achievement was not higher in either of these two models than the other (p. 13).

Block Scheduling and Instructional Practices

Classroom instruction and the level of rigor presented to students in their classes directly impacts the degree of student learning. With that, developing a schedule that could potentially facilitate better, more rigorous classroom instruction is a priority for school administrators and leaders. As a core function, school leaders need to set the conditions for positive and rigorous classroom experiences leading to optimal student achievement. Canady and Rettig (1996) assert that block scheduling can have a positive impact on student learning as a result of teachers employing better instructional strategies (p. 160). Unfortunately, research has demonstrated inconsistencies with the impact of block scheduling in this area. Mayers and Zepeda (2006) found that through their meta-analysis of several research studies focusing on the impact of block scheduling on instructional practices that block scheduling had no effect (p. 161).

Conclusion

The journey through the body of research that currently exists on the topic of scheduling and student achievement clearly marks inconsistent findings on the benefit of each school structure on student achievement and instructional practices. Given the inconsistencies and the resurging demand to leverage the school schedule for the benefit of students, a current study on the topic utilizing standardized assessments and an expanded focus to include academic achievement and level of learning activities is necessary. Today's schools continue to focus on the need for high levels of achievement for their students, but also complement that focus with providing well rounded rigorous learning experiences for them as well. Considering the core tenets of the Constructivist Theory, a schedule entrenched in this theory could potentially yield

high levels of achievement and quality, constructive learning experiences for students. As a result, utilizing this conceptual framework to engage in a study with current, relevant measures provides a valuable perspective to the ongoing dialogue on this topic.

This research serves as beneficial to others that have conducted research on this topic for several reasons. First, the research expands the current breadth of research to include a Pennsylvania standardized set of assessments, the Keystone Exams. Given that the Keystone Exams are aligned to a nearly national set of academic standards, the Common Core Standards, the research also provides a relevant and timely gauge on the potential impact of block scheduling with this new structure. In addition, expanding the research to determine the potential impact on the level of rigorous learning activities planned for and delivered in this structure helps to further the conversation on whether changing the schedule type can impact instructional practices.

This research may also prove beneficial to practitioners. As previously mentioned, both Pennsylvania Chapter IV and the recent enactment of ESSA provide for greater flexibility for schools to better leverage the schedule for learning. This research may provide part of the platform for practitioners to substantiate their decisions to engage in schedule discussions or schedule decisions.

CHAPTER 3

METHODS

This chapter discusses the design of the research methodology. While in general the study was designed to compare the achievement results of students in block and traditional schedules as well as the level of rigorous learning activities prevalent in each schedule type, the specific research questions for this study will be articulated below. This chapter is composed of six additional sections including setting, participants, data, analysis, participant rights, and potential limitations. Ultimately, the following information in each section will aid in providing connection between the conceptual framework for the study, the research questions for the work, and the methodology utilized to conduct the research.

Proponents of extended learning blocks, or block scheduling, advocate that longer instructional blocks, coupled with fewer administrative interruptions facilitate a more authentic and meaningful learning environment for students (Biesinger, Crippen, Muis, 2008). Fisher and Frey (2007) note a more consistent pace of classroom lessons, deeper learning, and better use of research based instructional strategies as a derivative of extended learning blocks (p. 210). It is often posed that as a result of longer instructional periods with fewer interruptions, students exposed to block scheduling have greater opportunities for interaction with the teacher, each other, and the content being learned (Canady & Rettig, 1995). Thus, this structure provides opportunities to capitalize on the core tenets of the Constructivist Theory.

As previously outlined, the Constructivist Theory or constructivism posits that learning is not linear and is a process by which the learner constructs their knowledge through interaction with content, experiences, and others. (College of Education, University of Houston, n.d., para. 6). Chudy, Juvova, Kvintova, Neumeister, and Plischke (2015), state that constructivist theory in

education focuses on "stimulating learners to interactivity, social communication and to the development of their own knowledge, structures of knowledge and to the critical assessment of information" (p. 346). Through their recommendations to capitalize on constructivism in schools, they call for continuity of learning, increased communication in the learning environment, and greater opportunities for collaborative learning (p. 347). As a result, a well-structured system of extended learning blocks, or block scheduling, should manifest in increased learning, if the result of the structure is in alignment with the Constructivist Theory. With relationship to this study, comparing the achievement results of schools in a block or traditional schedule, along with the level of rigorous learning activities prevalent in each schedule provides for a relatively direct measurement of whether positive effects of the constructivist theory are realized through block scheduling.

The research questions that frame the study include:

1. How do block and traditional school mean performances compare on the Pennsylvania Keystone Exams?
2. How does the frequency of rigorous learning activities that students experience in Pennsylvania Keystone Exam tested courses compare in a block versus traditional schedule?

While further elaboration will follow, this research is a mixed methods, comparative analysis. This mixed method approach can help to merge both primary methods of research and has the potential of capitalizing on the strengths of each (Creswell, 2003, p. 22). The study will utilize quantitative data gathered from the Pennsylvania's data warehouse, eMetric, and qualitative data gathered through administrator interviews.

Setting

In 2009, state leaders recognized the need for a national set of academic standards to ensure consistency in the quality and rigor of education provided across the United States. As a result, the National Governors Association and the Council of Chief State School Officers agreed to the launching of a somewhat universal set of academic standards. The educational landscape has changed nationwide as most states and school districts have subscribed to a national set of academic standards called the Common Core standards (www.corestandards.org, para. 1). The standards provided for increased rigor and better articulation of expectations, K-12 (para. 3). This set of core standards initiated significant school district curriculum revision and complete revisions of participating states' standardized assessment measures. Again, the goal was to consistently instruct and assess at a more rigorous level. As of August 2015, 42 states have adopted these rigorous standards as the backbone of their education system including instruction and assessment (para. 28).

Few studies on the impact of block scheduling on student achievement, under the newly adopted set of Common Core State Standards have been completed. As a result, this study bears significance for school districts across the United States. Beyond that, it also bears great significance throughout the Commonwealth of Pennsylvania considering the relative lack of previous studies on this topic conducted on a Pennsylvania standardized assessment measure. Within the Commonwealth of Pennsylvania, a shift in standardized assessments at the high school level happened in the 2012-2013 school year. During this year, Pennsylvania schools began being measured by an assessment titled the Keystone Exams. This exam type is designed to assess students in three areas prior to the conclusion of their 11th grade year. The assessment types include Algebra I, Biology, and Literature and are conducted as end of course exams. While administration of standardized assessments at the high school level was not new in

Pennsylvania, the utilization of a core standards aligned assessments, the Keystone Exams, was a change. Again, this study focusing on a new standardized Pennsylvania assessment, that is aligned to a relatively new set of rigorous standards, will provide value to researchers, practitioners, and key decision makers.

The focus for this particular study was in public school districts in South Central Pennsylvania. Given the focus of the research on the impact as measured through three Keystone Exams (Algebra I, Biology, and Literature), the study was narrowed to public high schools (grades 9-12) in South Central Pennsylvania. Given that these assessments are primarily administered at the high school level, a focus on the high school setting was logical. Narrowing the focus of the study to South Central Pennsylvania gave the researcher access in terms of proximity to travel to each site.

The data was collected in three phases throughout the study. A brief overview of those phases will be provided here and each phase of the study will be further elaborated upon in later sections of this chapter. The first phase included a survey to three regions in South Central Pennsylvania to determine which school districts utilize block or traditional scheduling at their high school level. The survey conducted was relatively brief considering the information sought and the probability of completion of a more brief survey by potential participants. A selection of schools and accompanying permission were sought from this survey data. For the purposes of this study, three schools utilizing block scheduling and three schools utilizing traditional scheduling formed the participant group. As will be outlined below, significant attention was paid to each school's demographic make-up to provide for some level of standardization.

The next phase included an analysis of academic achievement on the aforementioned standardized measures via a Pennsylvania public schools data warehouse called eMetric. The

data gathered for analysis included the mean proficiency rates for the three standardized assessments (Algebra I, Biology, and Literature). Finally, interviews were conducted with each of the building principals regarding the learning activities that were planned and prevalent in classrooms teaching content leading to each of the three standardized assessments.

Given the intricacies of conducting a study at one's own site, participant high schools were selected that did not include the researcher's place of employment. This decision was made given the researcher's position of authority within his place of employment and the potential for participant engagement in the study or data to be influenced. The researcher did include high schools within close proximity for the study to help facilitate travel for principal interviews and discussions.

Participants / Sample

When considering the focus of the study regarding the potential impact of a schedule type on academic achievement and prevalent learning activities, high schools were selected that had a relatively similar demographic. Beyond the initial grouping of all six schools selected, schools were then paired for comparison based on demographics and maintaining the greatest similarity between comparison groups of block and traditional schedule schools. Attempting to control for significant variations in the student demographics enabled the researcher to better limit factors influencing the above measures. The schools selected included six South Central Pennsylvania high schools, including three traditionally scheduled high schools and three block scheduled high schools. The traditionally scheduled high schools included Bermudian Springs High School, Mechanicsburg Area Senior High, and Northern (York) High School. The block scheduled schools included Boiling Springs High School, Shippensburg Area Senior High, and Greencastle-Antrim High School. The ethnic demographics for the region where the school

districts are located are 90.2% White, 3.8% Black, 3.8% Asian, and 2.2% multiracial. More specifically, the demographic breakdown for each school is outlined in Table 3, including the percentage of students identified as economically disadvantaged. Schools are presented in pairs, which served as the grouping for direct comparison.

Table 3
Participant School Demographics

School	White	Black	Asian	Hispanic	Multiracial	Economically Disadvantaged
Bermudian Springs HS	85.2%	0.5%	0.5%	13.4%	0.4%	35.4%
Shippensburg Area HS	88.1%	4.3%	2.1%	3.4%	2.1%	34.5%
Northern (York) HS	92.1%	1.2%	2.1%	2.9%	1.7%	19.6%
Boiling Springs HS	90.1%	1.1%	2.2%	3.0%	3.6%	12.9%
Mechanicsburg Area HS	81.3%	9.2%	3.4%	4.6%	1.5%	28.5%
Greencastle-Antrim HS	90.3%	1.7%	1.5%	2.3%	4.1%	27.1%

The purpose of this study was to look at school-wide trends potentially demonstrating an impact of the schedule type on academic achievement and prevalence of rigorous learning activities in the classroom. As a result, school-wide data was sought rather than limiting or narrowing the data to individual students or even individual teachers. The data was gathered for the 2012-2013, 2013-2014, and 2014-2015 school years. Given this, multiple sections of each course were utilized as samples for the data in all school buildings. This provides the researcher with a significant data set and also limited the ability of outlier scores to skew the data. In addition to this benefit, teachers with varying degrees of experience were included in the study as it is indicative of an authentic school environment. Lastly, in an effort to ensure a level of schedule stability, only schools that have subscribed to their current mode of scheduling for more than three years were included in the study.

Data

Data from three academic years, 2012-2013, 2013-2014, and 2014-2015 were gathered from six schools in South Central Pennsylvania. Three schools utilize a traditional schedule and three schools utilize extended learning blocks via one of the models of block scheduling. An initial survey was utilized to identify potential high schools to target for inclusion in this study. The survey was emailed through a high school listserv to high school principals. The survey was intentionally brief to aid in a higher completion rate. The questions included:

1. School district name: (Text box)
2. What type of schedule does your high school or high schools (if multiple) use? (Checkbox of traditional or block with descriptions of each).
3. How long has your high school or high schools (if multiple) used their current schedule? (Checkbox of year ranges: 0-2, 3-5, 6+)

Following the collection of this survey data, the results were analyzed so that target schools could be identified and permission could be sought through each school district's superintendent of schools. Permission to conduct the study at each of the six aforementioned sites was the result of this process. Data regarding student academic achievement was then gathered at the school level through a data warehouse called eMetric. This site provides the data as a school district report card by school year. While minor modifications to schedules happen nearly every academic year, all of the participant schools selected utilized their mode of scheduling for at least three years prior to data collection. As outlined above, this information was collected with the survey instrument used initially.

Qualitative data was then collected regarding the prevalence of rigorous learning activities planned and happening within the assessed courses. Interviews were set up with each building principal in the six participating high schools. The interviews were conducted on the

participating high school campuses. The tool utilized to structure the interviews included a standardized list of questions for each interview (Appendix A). The purpose of the interviews was to gather summary data regarding the learning activities observed through formal and informal classroom observations by the building principal and also to analyze three lesson plans, one for Algebra I, one for Biology, and one for Literature in each building. The data was collected to gain an understanding of the prevalence of learning activities in each assessed area as it relates to Webb's Depth of Knowledge and the four corresponding levels of learning activities. Member checks were structured within the interview process to gain confirmation on the classification of the learning activities. Prior to the formal interview questions, the researcher provided a brief overview of Webb's Depth of Knowledge, regardless of the comfort level of the interviewee. This provided for a more common understanding of the framework during the interview process. Merriam (2009) outlines that member checks are conducted on emergent findings to determine accuracy of those findings (p. 217). Within this research, the interviewer summarized the learning activities that the interviewee described and both then classified the learning activities according to the levels of Webb's Depth of Knowledge. This enabled the researcher to gain feedback on the findings and also help to ensure participant review of the interviewer's interpretation of the data.

Analysis

A comparative analysis was completed to determine differences between paired high schools utilizing different schedule types with regard to student academic achievement and prevalent levels of learning activities. Brunlow, Cozens, Hinton, and McMurray (2004) assert that most research involves a comparison of two groups if differences exist as a result of the experiment or treatment. Ultimately, this research involved that very concept determining if

differences exist as a result of the schedule treatment. Due to this structure, a two tailed t-test was utilized to determine if such differences existed among the participant high schools using the two schedule types. Runkel (2013) outlines that "A t-test is commonly used to determine whether the mean of a population significantly differs from a specific value or from the mean of another population" (para. 6). The two tailed t-test provided for a comparative analysis of the achievement scores both above and below the mean.

The independent variables for the comparative analysis were the schedules for each specific high school. The dependent variables included academic achievement for Algebra I, Biology, and Literature at each school and prevalent levels of learning activities at each school for Algebra I, Biology, and Literature classrooms. Mean achievement scores were aggregated for the three traditionally scheduled schools by subject area and the same was done for the block scheduled schools. A two tailed t-test was then conducted to determine if the mean achievement scores differed significantly from the traditionally scheduled schools to the block scheduled schools in the pairing.

The qualitative data collected through the administrator interviews regarding the level of rigor prevalent in classrooms were coded according to Webb's Depth of Knowledge and then aggregated by schedule type. Webb's Depth of Knowledge is a framework developed by Norman Webb to help categorize learning activities according to the complexity of thinking needed by the learners to complete the activity or task (Aungst, 2014, para. 2). The framework is structured in four levels including Level 1: Recall and Reproduction, Level 2: Skills and Concepts, Level 3: Strategic Thinking, and Level 4: Extending Thinking. As one progresses from Level 1 through Level 4, the complexity of thinking required to complete the learning activity progresses (para. 6). This model has not only gained attention by educators for the

construction of more rigorous lessons, but Pennsylvania also utilizes the model for the construction of the Keystone Exams (Pennsylvania Department of Education, 2012, p. 1). The interviews included a collaborative analysis and coding of the level of learning activities prevalent in a lesson plans for each assessment area as well as the prevalence of rigorous learning activities observed by the building principal in classes teaching the assessed content. These scores were then aggregated and a mean score was developed for each scheduled type based on the level of rigor prevalent in the classrooms and lesson plans. A two-tailed t-test was then completed to compare the means to note any differences between the two schedule types.

Participant Rights

At the onset of the study, superintendents of school districts were contacted to have their high school participate in this research study and informed consent was secured through the process. Beyond that, each building principal was then informed about the research via informed consent and given the opportunity to participate or opt out of participation. Those individuals that decided to move forward were made aware of the voluntary nature of the study and also provided with information regarding their ability to withdraw from the study at any time and for any reason.

As part of the informed consent process, participants were made aware of the measures that would be taken to ensure that data gathered either directly from them or about their school would be kept confidential and that identifying information would not be articulated via the research study. Part of the measures utilized to keep the schools information confidential was the removal of identifiers and the use of generic school names to identify the data such as Traditional 1, Traditional 2, Traditional 3, Block 1, Block 2, and Block 3. These identifiers were randomly assigned to the participating schools to aid in providing anonymity.

Potential unintended outcomes of participation in the study included a possible feeling of pressure by the building principals to participate in the study, given that their superintendent had already granted permission. To address this issue, informed consent utilized with the superintendents outlined the voluntary nature of the study for them and also that it was completely voluntary for their building principal. This construct of the research was articulated to the building principals via the informed consent, making them aware that even though their superintendent had granted approval, that their involvement was still voluntary.

Another potential unintended outcome of participation could be the reporting of findings that could compromise the relationship of the principal with supervisors, other administration, teachers, or other building stakeholders. Steps were taken to address this potential outcome by coding the data with anonymous identifiers. This step helped to make the reporting of the data by school unidentifiable.

Potential Limitations

This research study has several inherent limitations. As an administrator in a district that utilizes a block schedule, the researcher's experiences may have provided bias either in favor of or against a schedule type. Steps were taken to address this limitation including not using the researcher's school site, utilizing standard questions for building principal interviews, and including data from standardized assessment sets rather than more subjective measures.

Several limitations also exist when considering the ability to generalize the results. First, the data that was included regarding the academic achievement was impacted by one assessment type; the Pennsylvania Keystone Exams. While three different types of Keystone Exams were utilized (Algebra I, Biology, and Literature), the measure is still singular with regard to the type of assessment. Secondly, data was gathered over a three year period to be included in this study.

While the data set is certainly robust, additional data would aid in providing increased reliability to the study. Additionally, the reporting of the learning activities was done partially through self-reporting by the building principal during the interviews. The reporting may not have been as accurate as direct classroom observation for a variety of reasons.

Lastly, the findings of this research are limited by the number of other factors that impact student academic achievement and learning activities in the classroom. Some of those factors include parental involvement (Boon, 2008; Lee & Shute, 2010), leadership practices (Hoy & Sweetland, 2001), teacher experience, dedication, and effort, (May & Supovitz, 2011; Nettles & Herrington, 2007). Generalizing the results widely should be done with caution considering this limitation.

CHAPTER 4

RESULTS

This chapter is comprised of four primary sections: research questions, demographics, analysis methods and results, and results summary. Research questions and the linked null hypotheses are provided in the first section. A demographics overview is presented in the second section along with a reiteration of the school pairings for comparative purposes. The third section outlines the data analyses that were conducted through the series of independent t-tests, comparing mean student achievement scores and rigor levels experienced in block and traditional scheduled schools. The final section summarizes the results of the study.

Research Questions

Again, the purpose of this mixed-methods study was to examine the relationship of both block and traditional scheduling to student achievement and the level of rigor (Webb's Depth of Knowledge) designed for classrooms in each schedule structure. Data for the study were collected over three school years for each of the participating schools; 2012-2013, 2013-2014, and 2014-2015.

The primary research questions providing the framework for this study were:

1. How do block and traditional school mean performances compare on the Pennsylvania Keystone Exams?
2. How does the frequency of rigorous learning activities that students experience in Pennsylvania Keystone Exam tested courses compare in a block versus traditional schedule?

A non-directional null hypothesis was tested for the first research question. It was tested that no significant difference will exist in the academic achievement of the students on the

standardized assessments in a block or traditional schedule. The first question yielded three separate null hypotheses that were:

1. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Algebra I test mean for block schedule schools and u_2 = the population Algebra I test mean for traditional schedule schools).
2. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Biology test mean for block schedule schools and u_2 = the population Biology test mean for traditional schedule schools).
3. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Literature test mean for block schedule schools and u_2 = the population Literature test mean for traditional schedule schools).

A non-directional null hypothesis was tested for second research question as well. It was tested that no significant difference will exist in the mean level of Webb's Depth of Knowledge in the Keystone Exam assessed courses in block or traditional schedules. The null hypothesis that was tested was:

2. The mean level of Webb's Depth of Knowledge will not be significantly different in block scheduled courses than traditional scheduled courses ($H_a = u_1-u_2=0$, where u_1 = the mean level of Webb's Depth of Knowledge in block scheduled schools and u_2 = the mean level of Webb's Depth of Knowledge in traditional schedule schools).

Demographics

The participants for this study included a total of six high schools in the South Central Pennsylvania region. Three of the participating high schools subscribed to a block schedule format, whereas the other three participating high schools utilized a traditional schedule. The participating schools' data represent that of approximately 12,020 students, where 6,479 were from traditionally scheduled high schools and 5,541 were from a block scheduled school. The schools were paired with a comparison school based on similarity of student demographics. The paired schools and their student demographic information is listed in Table 4.

Table 4
Paired School Demographics

School	White	Black	Asian	Hispanic	Multiracial	Economically Disadvantaged
Traditional School 1	85.2%	0.5%	0.5%	13.4%	0.4%	35.4%
Block School 1	88.1%	4.3%	2.1%	3.4%	2.1%	34.5%
Traditional School 2	92.1%	1.2%	2.1%	2.9%	1.7%	19.6%
Block School 2	90.1%	1.1%	2.2%	3.0%	3.6%	12.9%
Traditional School 3	81.3%	9.2%	3.4%	4.6%	1.5%	28.5%
Block School 3	90.3%	1.7%	1.5%	2.3%	4.1%	27.1%

Analysis Methods and Results

This section will provide an analysis of the data collected for the comparison of mean achievement in a block and traditional schedule and the level of rigor experienced by students in each schedule type. As will be elaborated upon in the following paragraphs, the school pairings provided in Table 2 were utilized to examine the first research question to compare mean achievement data. When comparing the level of rigor that students are experiencing, qualitative data gathered via principal interviews was aggregated by schedule type for the purposes of comparison.

Keystone exam scores.

Data gathered from the six high schools in the South Central Pennsylvania region were used to address the research questions of this study. Data collected to address the null hypotheses associated with the first research question were gathered for three school years (2012-2013, 2013-2014, and 2014-2015). Each null hypothesis for the first research question was then analyzed for each paired set of schools. This led to three sets of data to analyze for each null hypotheses; one for each pair of schools.

For the purposes of a comparison of means for both the block and traditional schools, the analysis completed was an independent t-test for two samples; one block school and one traditional school. The independent variable for this study was the schedule format and the dependent variable for the first research question was mean student achievement. In order to ensure optimal statistical accuracy, several assumptions regarding the data need to be confirmed prior to completing the t-test. First, both groups should be unrelated or independent. Considering that the all data sets were gathered from different school entities, this was confirmed for all data sets. Next, it is important to set a significance level, or alpha level, in order to accept or reject the null hypothesis and also to determine the normality or homogeneity of the dependent variable for the data (Laerd Statistics, para. 4). The significance value for both applications was set at 0.05. To confirm normality of the dependent variable, the p-value or significance value driven by Levene's Test for Equality of Variances was analyzed to determine if it was greater than the alpha value of 0.05. Once confirmed, the t-test for both samples was conducted to reject or retain the null hypothesis for the data sets. Within this study, and specifically for the first research question, the general null hypothesis was that no significant difference existed between the performances of students in a block or traditionally scheduled

school on three Keystone Exams over three academic years. Again, the significance value set for the t-test was 0.05.

The tool utilized to conduct the data analyses was IBM SPSS Statistics. Selection of this tool to complete the data analyses for this study was based on a variety of factors. First, SPSS is considered to be one of the more prevalent data analysis software packages available and is used in a variety of settings. Beyond that, the researcher has developed a level of relative comfort with this software package from previous experiences with data analysis.

Traditional School 1 and Block School 1 analysis.

The first pairing of the schools include Traditional School 1 and Block School 1. The first null hypothesis tested was:

> *Null Hypothesis #1: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam (H_a = u_1-u_2=0, where u_1 = the population Algebra I test mean for block schedule schools and u_2 = the population Algebra I test mean for traditional schedule schools).*

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Algebra I scores for this school pairing, the p-value was 0.154, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.763, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = -0.323$, $p=0.763$). Table 5 shows the Independent Samples t-test report. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Algebra I Keystone scores for these schools.

Table 5
Traditional School 1 – Block School 1 Algebra Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
Variance	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	3.076	.154	-.323	4	.763

The second null hypothesis was then tested for Traditional School 1 and Block School 1 of:

> *Null Hypothesis #2: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam (H_a = u_1-u_2=0, where u_1 = the population Biology test mean for block schedule schools and u_2 = the population Biology test mean for traditional schedule schools).*

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Biology scores, the p-value was 0.069, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.676, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = -0.450$, $p=0.676$). Table 6 shows the report generated when completing this analysis within SPSS. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Biology Keystone scores for these schools.

Table 6
Traditional School 1 – Block School 1 Biology Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Variance					
Equal variances assumed	6.130	.069	-.450	4	.676

The third null hypothesis was then tested for this pairing of schools. The null hypothesis was:

> *Null Hypothesis #3: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Literature test mean for block schedule schools and u_2 = the population Literature test mean for traditional schedule schools).*

Again, homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Literature scores, the p-value was 0.147, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.175, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = 1.648$, $p=0.175$). Table 7 provides the results of the Independent Samples t-test. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Literature Keystone scores for these schools.

Table 7
Traditional School 1 – Block School 1 Literature Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
Variance	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	3.224	.147	1.648	4	.175

Traditional School 2 and Block School 2 analysis.

The second pairing of the schools include Traditional School 2 and Block School 2. The first null hypothesis tested was:

Null Hypothesis #1: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam (H_a = u_1-u_2=0, where u_1 = the population Algebra I test mean for block schedule schools and u_2 = the population Algebra I test mean for traditional schedule schools).

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Algebra I scores, the p-value was 0.167, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.175, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = -1.648$, $p=0.175$). Table 8 reports the data from the analysis that was completed. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Algebra I Keystone scores for these schools.

Table 8
Traditional School 2 – Block School 2 Algebra I Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
Variance	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	2.841	.167	-1.648	4	.175

The second null hypothesis was then tested for Traditional School 2 and Block School 2 of:

> *Null Hypothesis #2: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam (H_a = u_1-u_2=0, where u_1 = the population Biology test mean for block schedule schools and u_2 = the population Biology test mean for traditional schedule schools).*

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Biology scores, the p-value was 0.559, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.431, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = 0.875$, $p=0.431$). Table 9 outlines the report generated for the Independent Samples t-test. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Biology Keystone scores for these schools.

Table 9
Traditional School 2 – Block School 2 Biology Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Variance					
Equal variances assumed	.406	.559	.875	4	.431

The third null hypothesis was then tested for this pairing of schools. The null hypothesis was:

> *Null Hypothesis #3: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Literature test mean for block schedule schools and u_2 = the population Literature test mean for traditional schedule schools).*

Again, homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Literature scores, the p-value was 0.304, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.505, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = 0.731$, $p=0.505$). Table 10 outlines the report generated for the Independent Samples t-test. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Literature Keystone scores for these schools.

Table 10
Traditional School 2 – Block School 2 Literature Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Variance					
Equal variances assumed	1.391	.304	.731	4	.505

Traditional School 3 and Block School 3 analysis.

The final pairing of the schools include Traditional School 3 and Block School 3. The first null hypothesis tested was:

> *Null Hypothesis #1: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam (H_a = u_1-u_2=0, where u_1 = the population Algebra I test mean for block schedule schools and u_2 = the population Algebra I test mean for traditional schedule schools).*

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Algebra I scores, the p-value was 1.000, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.171, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = 1.665$, $p=0.171$). Table 11 outlines the report generated for the Independent Samples t-test. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Algebra I Keystone scores for these schools.

Table 11
Traditional School 3 – Block School 3 Algebra I Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Variance					
Equal variances assumed	.000	1.000	1.665	4	.171

The second null hypothesis was then tested for Traditional School 3 and Block School 3 of:

> *Null Hypothesis #2: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam (H_a = u_1-u_2=0, where u_1 = the population Biology test mean for block schedule schools and u_2 = the population Biology test mean for traditional schedule schools).*

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Biology scores, the p-value was 0.854, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.399, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = 0.943$, $p=0.399$). Table 12 outlines the report generated for the Independent Samples t-test. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Biology Keystone scores for these schools.

Table 12
Traditional School 3 – Block School 3 Biology Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
Variance	F	Sig.	t	df	Sig. (2-tailed)
Equal variances assumed	.039	.854	.943	4	.399

The third null hypothesis was then tested for this pairing of schools. The null hypothesis was:

> *Null Hypothesis #3: Students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Literature test mean for block schedule schools and u_2 = the population Literature test mean for traditional schedule schools).*

Again, homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of Literature scores, the p-value was 0.679, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.178, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = 1.632$, $p=0.178$). Table 13 outlines the report generated for the Independent Samples t-test. This data analysis may suggest that schedule type did not demonstrate a statistically significant impact on Literature Keystone scores for these schools.

Table 13
Traditional School 3 – Block School 3 Literature Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Variance					
Equal variances assumed	.198	.679	1.632	4	.178

Webb's Depth of Knowledge – Rigor Analysis

Data analyzed within this section were collected to address the research question:

How does the frequency of rigorous learning activities that students experience in Pennsylvania Keystone Exam tested courses compare in a block versus traditional schedule?

Proponents of block scheduling iterate that longer class periods enable teachers to dive more deeply into content (Biesinger, Crippen, Muis, 2008, p. 192). Theoretically, as this structure provides longer class periods it also enables teachers and schools to capitalize on key tenets of constructivism. Within this model, the additional time is thought to provide greater opportunities for the students to make meaning of the content through social interactions, interactions with the content, and authentic application of their learning (Chudy et al., 2015, p. 346). When engaged in the aforementioned learning activities or activities to apply learning, the level of rigor increases. This specific research question directly addressed the comparison of rigorous learning activities in both types of schedules.

Data collected to address this research question and the subsequent null hypothesis were gathered from interviews conducted of the building principals in each of the six participating high schools. First, each principal provided one sample lesson plan from the three Keystone

assessed courses; Algebra I, Biology, and Literature. During the interviews, the researcher and the principal analyzed the lesson plans collaboratively and coded the learning activities as one of four levels of rigor, according to the framework of Webb's Depth of Knowledge (Appendix B – Webb's Depth of Knowledge Overview Chart). This method of coding not only provided for adherence to a defined framework for data coding, but embedded member checks throughout the interview as the coding was done collaboratively.

This information was then complemented with an overall summative Depth of Knowledge score given by each principal of the typical learning activity levels prevalent in each tested subject area. The subject area summative rating was based upon the principal's formal or informal observations of the applicable classrooms.

Together, this data provided two data points per subject area, per school; one Webb's Depth of Knowledge level from the lesson plan and one from the principal's summative rating based on observational data. These assigned level ratings were then aggregated by schedule type and a mean score was then calculated for each schedule type. Arriving at a mean enabled the researcher to minimize the impact of outlier, discrete scores in the participant sample.

For the purposes of a comparison of means for both the block and traditional schools, the analysis completed was an independent t-test for two samples; traditional scheduled schools and block scheduled schools. In order to ensure optimal statistical accuracy, several assumptions regarding the data need to be confirmed prior to completing the t-test. First, both groups should be unrelated or independent. This independence of the data sets had been previously established given that separate schools formed the dataset. Next, it is important to set a significance level, or alpha level, in order to retain or reject the null hypothesis and also to determine the normality or homogeneity of the dependent variable for the data (Laerd Statistics, para. 4). The significance

value for both applications was set at 0.05. To confirm normality of the independent variable, the p-value or significance value driven by Levene's Test for Equality of Variances was analyzed to be greater than the alpha value of 0.05. Once confirmed, the t-test for both samples was conducted to reject or retain the null hypothesis for the data sets. Again, for this research question the general null hypothesis was that no significant difference existed between the mean level of learning activities in a block or traditionally scheduled school Keystone Exams assessed courses. The significance value set for the t-test was again 0.05. Following is the null hypothesis:

> *Null Hypothesis #4: The mean level of Webb's Depth of Knowledge will not be significantly different in block scheduled courses than traditional scheduled courses ($H_a = u_1-u_2=0$, where u_1 = the mean level of Webb's Depth of Knowledge in block scheduled schools and u_2 = the mean level of Webb's Depth of Knowledge in traditional schedule schools).*

Homogeneity of variance was tested for the data sets and compared to the p-value of 0.05. For this comparison of levels of rigor (Webb's Depth of Knowledge), the p-value was 0.522, which is greater than the alpha level, indicating homogeneity of variance or that equal variances can be assumed. The independent t-test was run on the data with a 95% confidence interval (alpha = 0.05) for the mean difference. It was found that the significance of the two-tailed t-test was 0.075, which is greater than the p-value of 0.05 indicating that the null hypothesis should be retained ($t(4) = -2.390$, $p=0.075$). Table 14 outlines the report generated for the Independent Samples t-test. This analysis may demonstrate that schedule type did not significantly impact the level of rigor experienced in classrooms in either schedule type.

Table 14
Traditional Schools – Block Schools Webb's Depth of Knowledge Level Mean Comparison

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Variance					
Equal variances assumed	.492	.522	-2.390	4	.075

Results Summary

Chapter 4 presented the findings of the research questions using an independent t-test. The t-test was utilized to determine if there was a significant difference in mean achievement scores and the level of rigor experienced by students between traditional and block scheduled schools. The first series of t-tests focused on the mean achievement comparison and the second t-test focused on a comparison of the mean level of rigor experienced by students in a traditional versus block schedule.

Null hypothesis 1 provided that students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam. This hypothesis was supported in all three paired school comparisons conducted for this subject area assessment. That data derived by the independent samples t-test for the three pairs of schools were ($t(4) = -0.323$, $p=0.763$) for Traditional School 1 – Block School 1, ($t(4) = -1.648$, $p=0.175$) for Traditional School 2 – Block School 2, and ($t(4) = 1.665$, $p=0.171$) for Traditional School 3 – Block School 3. From this, the data supports that there was no significant difference in the mean scores on the Algebra I Keystone Exam for students in a traditional or block schedule over the defined three academic years.

Null hypothesis 2 outlined that students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam. This hypothesis

was supported in all three mean comparisons conducted for this subject area assessment. That data derived by the independent samples t-test for the three pairs of schools were ($t(4) = -0.450$, $p=0.676$) for Traditional School 1 – Block School 1, ($t(4) = 0.875$, $p=0.431$) for Traditional School 2 – Block School 2, and ($t(4) = 0.943$, $p=0.399$) for Traditional School 3 – Block School 3. From this, the data supports that there was no significant difference in the mean scores on the Biology Keystone Exam for students in a traditional or block schedule over the defined three academic years.

Null hypothesis 3 provided that students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam. This hypothesis was supported in all three mean comparisons conducted for this subject area assessment. That data derived by the independent samples t-test for the three pairs of schools were ($t(4) = 1.648$, $p=0.175$) for Traditional School 1 – Block School 1, ($t(4) = 0.731$, $p=0.505$) for Traditional School 2 – Block School 2, and ($t(4) = 1.632$, $p=0.178$) for Traditional School 3 – Block School 3. From this, the data supports that there was no significant difference in the mean scores on the Literature Keystone Exam for students in a traditional or block schedule over the defined three academic years.

Finally, null hypothesis 4 outlines that the mean level of Webb's Depth of Knowledge will not be significantly different in block scheduled courses than traditional scheduled courses. This hypothesis was supported in the mean comparison that was conducted. The data derived by the independent samples t-test for traditional and block scheduled schools was ($t(4) = -2.390$, $p=0.075$). This demonstrates that the data supports that there was no significant difference in the mean level of Webb's Depth of Knowledge in block scheduled courses than traditional scheduled courses.

Chapter 5 further discusses the findings of the study, implications that it may have, recommendations for action and further study, and conclusions.

CHAPTER 5

CONCLUSIONS

The previous chapter provided results for the data collected for this study along with the analyses conducted in the comparison of student achievement and the level of rigor experienced in Keystone Exam assessed courses. Ultimately, this study examined two primary research questions and corresponding null hypotheses to determine if a school's schedule structure impacted either of the two areas compared. Much promise has been placed in focusing on alterations in school schedule structures as a way to effectively institute school reform around teaching and learning, and also increase student achievement (Sturgis, 1995). The perceived benefits to changing the schedule type resulted in significant shift to a block scheduling format throughout the mid to late 1990's. As documented by the North Carolina Department of Public Instruction, in the 1992-1993 school year, approximately 2% of North Carolina Public Schools utilized a block schedule. By 1997, that percentage had increased to over 65% of North Carolina Public Schools utilizing a block scheduling format (1997 Survey Results, para. 2).

Despite the significant shift to block scheduling and the continued interest in examining the school schedule as a possible tool to leverage for student achievement and experiences, convincing data to support this shift to block scheduling has been marginal at best (Mayers & Zepeda, 2006; Gruber & Onweugbuzie 2001; Ford, 2015). As a result of the mixed results found in the body of research on this topic and the continued interest in the topic, the purpose of this study was to further examine the relationship of block and traditional scheduling to student achievement and to the level of rigorous learning activities present in classrooms of each schedule type. Completing a current study enabled the researcher to determine schedule impact on student achievement utilizing data from an assessment system that subscribes to a new, nearly

national set of standards. Executing the research in Pennsylvania provided for the research dialogue to be extended in a state where the topic has been relatively unexplored formally. In addition, expanding the focus to examine the impact of schedule type on the level of rigorous learning activities prevalent in the classroom enabled the researcher to address the core promise of block scheduling; deeper learning experiences for students. Proponents of block scheduling assert that longer class periods, such as those in the block schedule, provide for greater opportunity for deeper, more meaningful learning (Canady and Rettig, 1995). Deeper, authentic learning is typically characterized by more rigorous learning and as such, this study focus gave the researcher an opportunity to compare levels of rigor experienced in both schedule types to determine if a significant difference exists.

After identifying potential participant school districts and schools, permission to conduct the study was solicited from each school district's superintendent. Upon gaining permission, additional permission was then sought from each high school's building principal. Student mean achievement data was gathered from each building principal for the three Keystone Exams (Algebra I, Biology, and Literature) for the three school years (2012-2013, 2013-2014, and 2014-2015). This data was harvested from a Pennsylvania Department of Education data warehouse (eMetric). Along with this information, principal interviews were conducted where three lessons plans, one for each Keystone Exam assessed area, were collaboratively analyzed and coded according to Webb's Depth of Knowledge (DOK) for rigor. This was complemented with a principal summative Webb's DOK level given to learning activities typically observed in Keystone Exam assessed course classrooms.

This chapter provides an interpretation of the findings of this study, finding implications, recommendations for action, recommendations for future study, and a final conclusion.

Interpretation of Findings

This study investigated two primary research questions. The first research question focused on differences in mean achievement scores on three Keystone Exams for students in block and traditional schedules. Specifically, the research question asked: How do block and traditional school mean performances compare on the Pennsylvania Keystone Exams? The question targeted all students at each participant high school that took each Keystone Exam over three academic years. The six participating high schools formed three separate pairs for comparison, based on their similarity of student demographics. The comparison of the mean achievement scores for each of the three Keystone Exams was then conducted.

This research question yielded three separate null hypotheses; one for each tested subject area. The null hypotheses were:

1. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Algebra I Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Algebra I test mean for block schedule schools and u_2 = the population Algebra I test mean for traditional schedule schools).
2. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Biology Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Biology test mean for block schedule schools and u_2 = the population Biology test mean for traditional schedule schools).
3. Students in a block schedule will not perform significantly different than students in a traditional schedule on the Literature Keystone Exam ($H_a = u_1-u_2=0$, where u_1 = the population Literature test mean for block schedule schools and u_2 = the population Literature test mean for traditional schedule schools).

Data utilized to investigate these null hypotheses were driven by the assessment results of 12,020 students over the three academic years. Within that general student population of all six participating high schools, 6,479 students received instruction in a traditional schedule format, whereas 5,541 students were in schools that adhered to a block schedule structure. To investigate each hypothesis correlated with the first research question, an independent t-test was performed on the student achievement means for each set of paired schools.

The first null hypothesis focused on a comparison of mean achievement scores for the Algebra I Keystone Exam. Data for this comparison were secured from each school for the 2012-2013, 2013-2014, and 2014-2015 school year. The t-tests conducted for this hypothesis indicated that for this study, no significant difference existed in the mean scores for all three comparisons conducted. That data derived by the independent samples t-test for the three pairs of schools were ($t(4) = -0.323$, $p=0.763$) for Traditional School 1 – Block School 1, ($t(4) = -1.648$, $p=0.175$) for Traditional School 2 – Block School 2, and ($t(4) = 1.665$, $p=0.171$) for Traditional School 3 – Block School 3.

The second null hypothesis focused on a comparison of mean achievement scores for the Biology Keystone Exam. Again, data for this comparison were secured from each school for the 2012-2013, 2013-2014, and 2014-2015 school year. The t-tests conducted for this hypothesis indicated that for this study, no significant difference existed in the mean scores for all three comparisons conducted. That data derived by the independent samples t-test for the three pairs of schools were ($t(4) = -0.450$, $p=0.676$) for Traditional School 1 – Block School 1, ($t(4) = 0.875$, $p=0.431$) for Traditional School 2 – Block School 2, and ($t(4) = 0.943$, $p=0.399$) for Traditional School 3 – Block School 3.

The final null hypothesis for the first research question focused on a comparison of mean achievement scores for the Literature Keystone Exam. Once again, data for this comparison were secured from each school for the 2012-2013, 2013-2014, and 2014-2015 school year. The t-tests conducted for this hypothesis indicated that for this study, no significant difference existed in the mean scores for all three comparisons conducted. That data derived by the independent samples t-test for the three pairs of schools were ($t(4) = 1.648$, $p=0.175$) for Traditional School 1 – Block School 1, ($t(4) = 0.731$, $p=0.505$) for Traditional School 2 – Block School 2, and ($t(4) = 1.632$, $p=0.178$) for Traditional School 3 – Block School 3.

For this research question, it can be concluded that regardless of the Keystone Exam tested area, mean achievement scores were not significantly different for students in schools utilizing a block or traditional schedule. While an array of studies exist in support of block scheduling to positively impact achievement (Evans, 2002; Payne & Jordan, 1996, Snyder, 1997), the findings of this study were strikingly similar to Duel's (1999) finding of no significant effect of block scheduling on student achievement. Lare, Jablonski, and Salvaterra (2002) had similar findings with a comparison of standardized testing results when analyzing advanced placement exams. They too found no significant difference between mean scores for students in a block or a traditional schedule.

The second research question for this study asked: How does the frequency of rigorous learning activities that students experience in Pennsylvania Keystone Exam tested courses compare in a block versus traditional schedule? The correlating null hypothesis for investigation was:

4. The mean level of Webb's Depth of Knowledge will not be significantly different in block scheduled courses than traditional scheduled courses ($H_a = u_1-u_2=0$, where $u_1 =$

the mean level of Webb's Depth of Knowledge in block scheduled schools and u_2 = the mean level of Webb's Depth of Knowledge in traditional schedule schools).

Data utilized to investigate this null hypothesis and research question were gathered during interviews of each building principal at each of the six participating school sites. Two data points were gathered for each Keystone Exam assessed area. The first was gathered as the building principal and researcher collaboratively coded lesson plan rigor based on Webb's Depth of Knowledge (DOK). The second data point was provided to the researcher by the principal as a summative level of Webb's DOK, based upon activities observed in each classroom through their formal and informal observations. These data points, again two per tested subject area per school, were aggregated by schedule type and the mean rigor level was then compared utilizing a t-test.

The t-test conducted for this hypothesis indicated that for this study, no significant difference existed in the level of rigor experienced by students in Keystone Exam assessed courses in a block or traditional schedule. The data derived by the independent samples t-test for traditional and block scheduled schools was ($t(4) = -2.390$, $p=0.075$).

For this second and final research question, it can be concluded that no significant difference existed in the level of rigor experienced by students in either schedule type. This marginal and statistically insignificant finding is compatible with the findings of Mayers and Zepeda (2006). Through their analysis of 58 empirical studies, they found inconsistent results of block scheduling and outlined that to impact achievement and learning that efforts needed to be exerted beyond merely allocating more time (p. 163). They stated that "if block scheduling is to be real reform, it should produce convincing empirical evidence of behavioral change in teachers and students who work in the context of a block schedule" (p. 163). Their analysis concluded

similar results that teaching behaviors and rigor wasn't significantly different in the two scheduling models. Specifically they stated that the "research failed to provide the evidence necessary to declare unequivocally that teachers' practices and student learning had changed and, therefore, that block scheduling was a real reform" (p. 163).

In addition to providing the data regarding the level of rigor experienced in Keystone Exam based classrooms, principals were also prompted with a question to support their ratings. The question addressed their perception of whether one schedule type could provide greater benefit to classroom rigor than another. Principal responses included the following; "There's no major advantage with either schedule. Rigor is possible in both" (Principal – Traditional School 1). "With a strong teacher, the schedule doesn't make a tremendous difference" (Principal – Block School 1). "High levels of rigor vary within our schedule and within departments. This shows me that the schedule could be less impacting than the teacher" (Principal – Traditional School 2). And finally, "If you select, develop, and support the best staff, the quality of the teacher surpasses the impact of the schedule" (Principal – Traditional School 3). These responses support their ratings of rigor in that neither schedule demonstrated statistically significant differences from the other. In addition, they indicate a collective perception of the teacher having greater impact than the schedule type.

Limitations

This research study has several inherent limitations. First, the researcher's experiences include serving as a district administrator in a school district where block scheduling is utilized as the schedule structure. These experiences had the potential to provide bias either in favor of or in opposition to a schedule type. To create separation with the researcher from the data, the

researcher's school district of employment was not selected as one of the participant school districts.

Several limitations also exist when considering the ability to generalize the results. First, the data that was included regarding the academic achievement was impacted by one assessment type; the Pennsylvania Keystone Exams. While three different types of Keystone Exams were utilized (Algebra I, Biology, and Literature), the measure is still singular with regard to the type of assessment. Secondly, data was gathered over a three year period to be included in this study. While the data set is certainly robust, including over 12,000 student assessment scores spanning six high schools, additional data would aid in providing increased reliability to the study.

A third limitation of the study was the subjective nature of the summative Webb's DOK level that the building principal provided for each Keystone Exam assessed area. While the assignment of a DOK level was based off of formal and informal principal observations and the coding of a level was linked to a framework, significant evidence to substantiate the coding would have provided for greater accuracy and reliability.

Another limitation to generalizing the findings of this study to a larger population of schools could also be the scope of the participant sample. The participant sample included six South Central Pennsylvania high schools. Again, while the data set was relatively robust, the schools generally represented a suburban demographic. This presents a limitation to generalizing the results to more rural or urban school districts.

Lastly, the findings of this research are limited by the number of other factors that impact student academic achievement and learning activities in the classroom. Some of those factors include parental involvement (Boon, 2008; Lee & Shute, 2010), leadership practices (Hoy & Sweetland, 2001), teacher experience, dedication, and effort, (May & Supovitz, 2011; Nettles &

Herrington, 2007). Generalizing the results widely should be done with caution considering this limitation.

Implications

Given current and even ongoing challenges in schools, quality transformative leaders are needed more today than ever in our educational system. As the education system is a direct reflection of society at large, issues encountered in society need to be proactively addressed within the context of our schools. As Shields (2010) outlines, transformative leadership "links education and educational leadership with the wider social context within which it is embedded" (p. 2). Effective transformative leaders are able to leverage their own unique platform to better serve as change agents for equity and justice.

Within the context of this study, this information is valuable to transformative leaders that may be looking to leverage their school schedules to better serve their students, community, and society in general. Increasing the opportunity for learning and enhancing the learning environment for students can not only yield better results for each individual student with regard to achievement at school, but can better prepare them for successful citizenry beyond their schooling years. This process enables a transformative leader to help capitalize on Shield's core tenets of *Emphasizing Both Public and Private Good.* More positive learning experiences can help students to pursue higher education, leading to better financial situations for them. As outlined by Cohn (2011), individual's with a bachelor's degree are estimated to earn over $1.4 million over a forty year career, compared to about $750,000 for a high school graduate over the same time period (para. 1). With regard to public benefit, more productive learning experiences also reduce the need for remedial services in higher education. It is estimated that nearly twenty-five percent of college freshmen had to enroll in some type of remedial coursework due to a lack

of readiness for entry level college courses (Vaughn, 2016, para. 1). This not only presents a cost to students and their families, but also to universities and lending institutions.

In addition to Shield's first core tenet of *Emphasizing Both Public and Private Good*, given the potential multi-generational impact of higher achievement and deeper learning, it also helps with *Effecting Deep and Equitable Change* (Shields, 2010, p. 17). Leveraging the school schedule can help transformative leaders to address the achievement gap in historically underperforming groups of students; students of color and students of poverty. Given the aforementioned information regarding earning potential for college graduates, creating positive learning environments and closing the achievement gap could help to break the cycle of underperformance by students fitting this demographic. Gill (2011) outlines the benefit of variations of scheduling on both black and Hispanic students at the middle school level. Continuing to leverage the schedule for optimal learning is a necessary continued focus for transformative leaders.

As teachers, administrators, school boards, or communities wrestle with the idea of leveraging the school schedule structure for increased learning, this research and the body of existing research is critical. This research provides for an updated comparison on student achievement and rigor experienced in both schedule structures. In addition, the achievement measures were taken from a new, nearly national set of academic standards. The current nature of this research helps to build out the body of existing research and may prove increasingly relevant to schools with similar demographics or situations as the participant schools for this study. As mentioned in Chapter I, from a national level, increased flexibility has been granted to school districts through the Every Student Succeeds Act (ESSA). Through this legislation, states and districts receive tremendous flexibility in the establishment of goals, building accountability

systems, and providing for corrective action to underperforming schools (Klein, 2015, para. 8). This flexibility enables transformative school leaders to not only act more boldly as change agents, but to also more creatively leverage the school schedule to provide students with meaningful and effective learning experiences.

At a more local level, the results from this research can prove beneficial to the same contingent of school leaders given the increased flexibility granted in 2014 through Pennsylvania's Chapter IV of the Pennsylvania Code. This revision to Chapter IV gave school districts greater flexibility with graduation requirements. The ability for school districts to more flexibly create their own graduation requirements now creates greater urgency for school leaders to best select schedule structures that support their course offerings for graduation. In addition, Chapter IV also included the subscription by the Commonwealth of Pennsylvania to the Common Core Academic Standards. This research, focused on assessments built off of those standards and courses aligned to those standards, can serve as valuable information for decision makers in the Commonwealth.

Recommendations for Action

As outlined previously, this study bears great significance for transformative leaders given the educational landscape of high schools today. The demand for higher student achievement is reinforced by the media and by school stakeholders on a regular basis. Whether it be through competition with other countries or in an effort to maximize the return on investment, accountability for higher student achievement is ever prevalent. Beyond that, transformative leaders have been granted significant flexibility both through national legislation and in the case of this study, by the Pennsylvania Department of Education. As a result, this

study and the body of existing research bear critical significance to those making decisions on school scheduling structures.

Several recommendations for action evolved as a result of this study. Parallel to the findings and conclusions of Andrews (2002), educational decision makers need not be concerned with declining standardized achievement scores when making bold decisions on schedule changes. While caution should continue to be exercised when making changes to the schedule given the impact to other, more administrative school functions, a fear that student achievement will be dramatically impacted can be put to rest.

Unfortunately, the data and analysis conducted for this study also reinforced the inverse of the aforementioned recommendation for action. Decision makers should also not view a change to the schedule alone as the catalyst to dramatic increases in student achievement. Again, given the comparison of the mean achievement scores and rigor experienced in classrooms, neither schedule structure presented data that demonstrated a statistically significant difference from the other. Again, this reinforces that schools should also not pursue a mere schedule change as the impetus to positive student achievement gains.

In terms of implications for action, school leaders should select school schedules that best enable them to deliver their school's educational program. Extended learning periods, like those evident in a block schedule, may lend themselves better to specific classes such as those with labs or skill based classes. On the contrary, more traditional schedules that utilize 45 to 50 minute classes over the course of an entire school year may prove to be more beneficial to establish consistency for learners in either foundational or advanced placement courses. In each course model, the course generally concludes with a late spring high stakes assessment. The traditionally scheduled course, extended over the entire school year, may more consistently

provide the students with extended opportunities to engage with the content, unlike the semester-based block scheduled courses. Again, decision makers need to focus on prescribing the schedule most conducive to their educational program without fear of the schedule alone having a dramatic impact on student achievement scores.

Along similar lines, if decision makers decide to modify or change the schedule structure to one that they believe will help better deliver their school's educational program, it is important to complement that change with meaningful and significant professional development and accountability. Extending the learning block gave promise to capitalizing on the constructivist learning theory. As outlined previously, Chudy, Juvova, Kvintova, Neumeister, and Plischke (2015) asserted that constructivist theory in education focuses on "stimulating learners to interactivity, social communication and to the development of their own knowledge, structures of knowledge and to the critical assessment of information" (p. 346). The promise of the extended learning periods inherent in a block schedule were greater interactions for students with each other, the teacher, and the content. Gabrieli (2010) asserts that merely extending time is not nearly enough. He states that to be successful, schools must focus on enhancing core instruction through professional development (p. 43). He iterates that "Successful expanded learning time schools are deeply committed to raising the quality of core instruction in every classroom through the use of data and collaborative improvement" (p. 43). Gabrieli calls for action by indicating that block schedules provide for greater opportunities for collaborative professional growth and that administrators must capitalize on this time and not "squander this time on low-intensity or administrative efforts and miss the chance to improve instructional effectiveness" (p. 43).

In terms of a direct implication for action, school leaders should closely complement schedule changes with meaningful professional development on the utilization of the time and accountability. Not only helping teachers learn how to best utilize the time, but embedding accountability for the most effective utilization of the time will ensure that teaching practices better suited for a traditional schedule aren't merely duplicated in an extended learning block.

In order to assist with potential implementation of the implications for action, the study needs to be disseminated, or at a minimum made available as a reference for transformative leaders in our schools. With regard to the study participants, the researcher agreed to make copies of the study available to the building principals and to the district superintendents that granted permission to be a part of the study. This information could help them to directly correlate the research results and conclusions to experiences that they have at their respective sites.

More widespread dissemination will be made to two primary online forums as well. First, the work will be made public to the University of New England's centralized online repository. This repository, called DUNE, can be accessed by other researchers and practitioners so that findings from this study can complement those of the existing body of research. Similarly, the research will be populated in another virtual platform called ProQuest. ProQuest serves in a similar capacity to DUNE, but spans multiple university and library platforms. Submitting this research to the participants and the two virtual platforms enables the researcher to help contribute locally, nationally, and globally to the body of research on the topic.

Recommendations for Further Study

Throughout this study, several themes for additional research or future study became evident. First, given the insignificant difference found between mean achievement scores and

level of rigor between schedule types, it became apparent that future study is needed around the impact and value of quality professional development. Despite the findings of insignificant differences in this study, other studies have demonstrated significant differences in achievement between block and traditionally scheduled schools. Examining the professional development utilized in those schools, or others indicating significant levels of achievement or rigor would be of value. Continuing the research dialogue on scheduling through this lens could help practitioners to discern between schedule impact on achievement and rigor versus the impact of quality and meaningful professional development. This work and subsequent findings could help practitioners to better focus their time and efforts on addressing the area, schedule or professional development, which could potentially yield the greatest return.

The second recommendation for additional research would be to replicate this study in future years, within the Commonwealth of Pennsylvania and around the same battery of assessments. Given the relatively recent establishment of the Keystone Exams as the state mandated battery of assessments, school districts are still adjusting to this measure as the defined target for each of the assessed courses. The process of aligning curriculum, defining benchmark assessments, and creating consistent and pervasive instructional practices aimed at these assessment anchors and eligible content take time. Over the next few years, schools will continue to better align the instruction and learning with these defined targets. As a result, future research could yield different results where the relative newness of this battery of assessments may have influenced the results of this research. Conducting the research later may better allow the full establishment of the assessment aligned instructional system to take hold and again, better facilitate research results that are less influenced by this factor.

Finally, researchers that decide to further explore this topic should consider focusing on other advantages of block scheduling, beyond student achievement or the level of rigor experienced in their classrooms. Several studies have been conducted on the impact of block scheduling on discipline, attendance, and dropout rates (Schott, 2008 and Williams, 2011). Other studies have focused on teacher perceptions of block and traditional scheduling (Dunham, 2009). Given the results of this study and others (Mayers and Zepeda, 2006), the direct impact of block scheduling on student achievement has yet to be settled. As a result, researchers should explore other potentially positive results of block scheduling that may be more meaningful to school district stakeholders. Whether the focus is attendance, discipline, alternative course offerings, or the creation of student learning communities, future research should examine other areas impacted by schedule type. This research would bear significance to decision makers in light of the consistently unsettled results found in the body of research of the impact of block scheduling on student achievement.

Conclusion

Closely following the establishment of a public education system, the utilization of time within the school day has become a significant focus of decision makers. Whether it be through the early influence of publications such as the *Report of the Committee of Ten* (1894), *Cardinals' Principles of Education* (1918), or the establishment of Carnegie Units by the Carnegie Commission in the early 20th Century, the school schedule has received great focus. Despite increased focus on leveraging the school schedule to facilitate optimal student achievement in the late 20th and early 21st Centuries, the conversation not only still remains relevant, but more importantly, relatively undecided.

The focus of this research was to determine the impact of block scheduling on student achievement on the Pennsylvania Keystone Exams and also on the level of classroom rigor experienced by students in those classes. This study bears significance on multiple fronts. First, the study effectively contributes to the dialogue surrounding schools' schedule impact. Mayers and Zepeda (2006) called for additional studies to be conducted on this topic and to focus on relevant standardized assessments. This research addresses that request by focusing on a new assessment battery adhering to a nearly national set of standards.

The study provides meaningful data to practitioners as well. Given the landscape of education today with continued high stakes accountability, schools continue to strive for optimal student achievement. Thus, leveraging the schedule to help meet achievement goals remains a relevant focus. Different from legislation in recent history, local and national legislation today provides for greater flexibility for leaders to act boldly to address student needs. School leaders today have more latitude to act as transformative leaders utilizing the educational program and the school schedule as a tool to deliver that program in a manner that can effectively address societal issues of equity and justice. Whether it be the creative establishment of the school schedule to effect deep and equitable change for students or to demonstrate moral courage by taking bold steps to close the achievement or opportunity gap, Shields (2010) calls on leaders to utilize their unique platforms to begin with questions of justice, power, and social responsibility (p. 12). This study helps leaders to have confidence when considering how best to leverage the schedule for transformative leadership.

Finally, based on the study's results, leaders should not view a movement to one schedule type or another as the ultimate catalyst to increased student achievement or rigor. The study and the conclusions clearly indicate that there was a lack of significance in the difference in

achievement and rigor experienced by students in block or traditionally scheduled schools. These results were not overly surprising to the researcher. Throughout the body of research, findings from other studies regarding school schedules were inconsistent. With that, the researcher anticipated results from this study that did not indicate significant impact of either traditional or block scheduling. Despite that, it is important to consider that these findings are limited to this specific study. Additional research with this focus, or expanding the focus on other positive areas impacted by schedule type could prove greatly beneficial to advancing this research dialogue.

Appendix A – Administrator Interview Questions

School Administrator Interview Index

Instructional Practices – Webb's Depth of Knowledge

Process: Prior to interviewing, administrators will be asked to bring one copy of a lesson plan for each Keystone Exam assessed course (Algebra I, Biology, and Literature). This evidence will be cooperatively analyzed within the interview.
Webb's Depth of Knowledge will be reviewed utilizing the attached resource to provide for common vocabulary and a foundational understanding of the levels of complexity inherent in the framework. Time will be provided for discussion and any clarifying questions regarding the framework as well.

Questions:

1. For the record, please state your name, your position, and the school that you serve.

2. What type of schedule do you currently utilize at your high school? (How many periods in a day? How long is each class period?)

3. How long have you utilized this type of schedule?

4. For principals at block scheduled schools – Were you here when the traditional schedule was utilized?

I'd like for you to think specifically of your Keystone Exam assessed courses (Algebra I, Biology, and Literature) and instructional practices / learning activities that typically happen within those settings, as based on your informal or formal classroom observations.

5. For your Algebra I classes, what types of activities do you currently see (list)?
    a. From those activities, let's review the DOK Resource. If we were to consider the activities that are most prevalent from the ones that you describe (potentially review the list with the interviewee), where would you see them falling on Webb's DOK?

6. For your Biology classes, what types of activities do you currently see (list)?
    a. From those activities, let's review the DOK Resource. If we were to consider the activities that are most prevalent from the ones that you describe (potentially review the list with the interviewee), where would you see them falling on Webb's DOK?

7. For your Literature classes, what types of activities do you currently see (list)?
    a. From those activities, let's review the DOK Resource. If we were to consider the activities that are most prevalent from the ones that you describe (potentially review the list with the interviewee), where would you see them falling on Webb's DOK?

Let's look at the lesson plans now. Let's work together to define the primary learning activities within the lesson.

8. Starting with the Algebra I lesson plan, what do you see as the primary learning activities?

   a. Looking at each of those activities, at what DOK level do you see them fitting?
   b. Do you believe this represents a typical day in Algebra I?

9. For the Biology lesson plan, what do you see as the primary learning activities?
   a. Looking at each of those activities, at what DOK level do you see them fitting?
   b. Do you believe this represents a typical day in Biology?

10. For the Literature lesson plan, what do you see as the primary learning activities?
   a. Looking at each of those activities, at what DOK level do you see them fitting?
   b. Do you believe this represents a typical day in Literature?

11. Do you believe that teachers could provide the same or even more rigorous learning activities in another type (block or traditional)?

12. Do you believe that the schedule type can have an impact on the level of rigorous activities that the teacher provides to students?

Appendix B – Webb's Depth of Knowledge Overview Chart

Level of Complexity (measures a student's Depth of Knowledge)	**Key Verbs That May Clue Level**		**Evidence of Depth of Knowledge**
Level 1 **Recall/Reproduction** Recall a fact, information, or procedure. Process information on a low level. *Comprehend/Understand* "Ability to process knowledge on a low level such that the knowledge can be reproduced or communicated without a verbatim repetition."	Arrange Calculate Cite Define Describe Draw Explain Give examples Identify Illustrate Label Locate List Match	Measure Name Perform Quote Recall Recite Record Repeat Report Select State Summarize Tabulate	• Explain simple concepts or routine procedures • Recall elements and details • Recall a fact, term or property • Conduct basic calculations • Order rational numbers • Identify a standard scientific representation for simple phenomenon • Label locations • Describe the features of a place or people • Identify figurative language in a reading passage
Level 2 **Skill/Concept** Use information or conceptual knowledge, two or more steps	Apply Calculate Categorize Classify Compare Compute Construct Convert Describe Determine Distinguish Estimate Explain Extend Extrapolate Find Formulate	Generalize Graph Identify patterns Infer Interpolate Interpret Modify Observe Organize Predict Relate Represent Show Simplify Solve Sort Use	• Solve routine multiple-step problems • Describe non-trivial patterns • Interpret information from a simple graph • Formulate a routine problem, given data and conditions • Sort objects • Show relationships • Apply a concept • Organize, represent and interpret data • Use context clues to identify the meaning of unfamiliar words • Describe the cause/effect of a particular event. • Predict a logical outcome • Identify patterns in events or behavior

Level of Complexity (measures a student's Depth of Knowledge)	**Key Verbs That May Clue Level**		**Evidence of Depth of Knowledge**
Level 3 **Strategic Thinking** Requires reasoning, developing a plan or a sequence of steps, some complexity *Evaluate* "Checks/Critiques – makes judgments based on criteria and standards."	Appraise Assess Cite evidence Check Compare Compile Conclude Contrast Critique Decide Defend Describe Develop Differentiate Distinguish	Examine Explain how Formulate Hypothesize Identify Infer Interpret Investigate Judge Justify Reorganize Solve Support	• Solve non-routine problems • Interpret information from a complex graph • Explain phenomena in terms of concepts • Support ideas with details and examples • Develop a scientific model for a complex situation • Formulate conclusions from experimental data • Compile information from multiple sources to address a specific topic • Develop a logical argument • Identify and then justify a solution • Identify the author's purpose and explain how it affects the interpretation of a reading selection
Level 4 **Extended Thinking** Requires an investigation, time to think and process multiple conditions of the problem. Most on-demand assessments will not include Level 4 activities. *Evaluate* Making value judgments about the method."	Appraise Connect Create Critique Design Judge Justify Prove Report Synthesize		• Design and conduct an experiment that requires specifying a problem; report results/solutions • Synthesize ideas into new concepts • Critique experimental designs • Design a mathematical model to inform and solve a practical or abstract situation. • Connect common themes across texts from different cultures • Synthesize information from multiple sources

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