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Standard Specific Student Achievement Scores and the Impact on Teacher Incorporation of Standards, Knowledge of Standards, and Student Achievement

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Standard Specific Student Achievement Scores and the Impact on Teacher Incorporation of Standards, Knowledge of Standards, and Student Achievement

by

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Dedication

This dissertation is dedicated to my family who has supported me through this process. To my wife Ashleigh who is my biggest supporter and to my children Beaumont, Bennett, and Boden. To my parents, grandparents, and sister who have supported me through my educational endeavors. To my current school district who has supported me through the process. To my friend Andy Anderson, who without his help, I would not have been able to complete this study.

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Abstract

There has been a steady focus in education on standards, assessment, and accountability. The purpose of this quantitative study was to find if research based PLCs focusing on standard specific student achievement data impacted teacher knowledge of standards, incorporation of standards, and student achievement. The research was guided by two research questions. Within the context of PLCs (data-based teams) utilizing standard specific student achievement data: 1) What impact, if any, was the use of PLCs on the teachers' knowledge and incorporation of standards into the classroom setting? 2) Did student achievement on standardized tests improve as the result of the level of teacher knowledge and incorporation of standards into the classroom?

The quantitative study was conducted over five years in a rural Minnesota school district. An anonymous survey was used to gather teacher opinion and student achievement data from the district. The study included thirty-three teachers who ranged from Pre-K to twelfth grade. Positivism was the theoretical framework for the study to find concrete information. The quantitative study found PLCs, with standard specific student achievement data, increased teacher knowledge of standards and incorporation of standards. The increased teacher knowledge of academic standards and incorporation of standards had a correlation to higher student achievement scores.

CHAPTER 1: Introduction

Education is shaped by legislation and policy and in the last twenty years, there has been a shift in education towards standards and accountability. Karr, Marsh, Ikemoto, Darilek, and Barney (2006) detailed how the legislation has created an environment in education that requires districts to monitor progress on standards and hold districts accountable. With this shift towards standards and accountability, there has been a shift in the way schools operate. According to Lai and McNaughton (2016) "there is an increasing international emphasis on using data as part of teacher and school leader decision-making to improve teaching and student achievement" (p. 1). The increased emphasis on data has brought about many ideas and processes on how to best use data to improve instruction and student achievement.

There has been an increased focus on standards and the student achievement scores associated with the tests based upon those standards. With the increased focus on data and progress monitoring, research has focused on the effective data practices, but not on impactful data types and its impact on teacher instruction and student achievement. A lost portion of this equation is the teacher knowledge level of standards themselves, their incorporation of the standards, and whether standards equate to student success.

This study focused on whether standard specific student achievement data are an impactful data type. There is research on standard specific student achievement data, but it has not detailed how this data type impacts standards incorporation, standards knowledge, and student achievement. The research attempted to determine whether standards specific student achievement data impacted teacher incorporation of standards into instruction, knowledge level of state standards, and whether standards resulted in a direct link to student growth levels as measured by standards.

Brief Literature Review

There has been limited research into the impact standard specific student achievement scores. Nabrs, Olah, Lawrence, and Riggan (2010) found that when using interim or progress monitoring assessments data, teachers used the benchmark reports to identify areas of emphasis, linked the reports to state standards, and if benchmark reports were not showing progress then teachers adjusted instruction. Bulkley, Christman, Goertz, and Lawrence (2019) also found that "assessments that fulfill an evaluative purpose by providing teachers, principals, and administrators with school-level information about how test items link to content standards can be meaningful tools for teachers" (p. 203). Although the benchmark report used by Nabrs, Olah et al. (2010) and Bulkley et al. (2019) differ from benchmark reports from the Minnesota Department of Education (2019) this research provides an example of what can be done with data that can be linked to academic standards.

Previous studies have focused on what successful data based decision-making looks like and the processes to make data based decision-making successful. Portman and Schildkamp (2016) found that successful data teams had access to high quality data, school leadership participation and support, and having a shared goal. These are concepts that are consistent across the literature, but the literature does not delve into specific types of data and their impacts. Studies that explore the association between student performance data usage and instructional change have not described the type of data used nor the type of standards set by the state.

There is also literature that defines successful professional learning communities (PLCs) or professional development. Themes of successful PLCs that are consistent across the literature are that PLC's provide collaboration time, are focused, and are ongoing. Ruchti, Jenkins, and Agamba (2013) identified that "a powerful insight was that 98–99 percent (strongly agree and

agree) of respondents indicated that their priority was collaborative time with other teachers" (p. 86). Collaboration was the strongest central factor in successful PLCs and staff development.

Polikoff (2012) noted that "studies generally indicated that 80–90 percent or more of teachers across states, grades, and subjects reported increases in instructional alignment over time" (p. 362). The Polikoff study is helpful in detailing how standards have increased instructional alignment, but the literature is limited. The current literature is sparse in detailing if student achievement data increases instructional alignment of standards or if teacher's incorporation of standards into instruction is impacted by student achievement data.

The literature is very limited on teacher knowledge of standards. The literature detailed alignment of standards and impacts on a variety of factors, but there is relatively little research on teacher knowledge of standards. Kanter and Kanstantopolous (2009) did link teacher knowledge of standards to student achievement. Kanter and Kanstantopolous (2009) found that teacher knowledge of "specific content area were statistically significant predictors of minority student achievement in mastering the same content at all levels of cognitive difficulty" (p. 871). This means the higher the teacher's knowledge of content or standards, the better students achieve.

Student achievement can be linked to a variety of topics. There has been research that has linked data-based decision making to student achievement, but not specific data types. Anderson, Leithwood, and Strauss (2010) found weak statistical evidence of a positive relationship between student achievement and district or school data use. There is limited research linking student achievement to teachers' knowledge of standards and incorporation of standards, but not research regarding specific types of data to student achievement. There is an absence of research on the impact of PLCs and data-based teams using standard specific student

achievement data on teacher knowledge of standards, incorporation of standards, and student achievement.

Statement of the Problem

The increased emphasis on data review by districts has brought about many ideas and processes on how to best use data to improve instruction, curriculum, and student achievement. Legislation has required schools to show progress through standardized tests, but Minnesota has not provided access to high quality and timely data from standardized tests. Is standard specific student achievement data high quality data that is impactful for teachers to improve their own knowledge of standards, the incorporation of standards, and the resultant impact on student achievement?

The Minnesota Department of Education's stated purpose on the Academic Standards (2019) is to "identify the knowledge and skills that all students must achieve by the end of a grade level or grade band." Students in select grades are tested on the Minnesota state standards through the MCA-III and MTAS. According to the Academic Standards (2019), the purpose of the MCA-III and MTAS is to "help districts measure student progress toward Minnesota's academic standards and also meet federal and state legislative requirements." The standards are a guide for local school districts, and the MCA and MTAS are used to measure student progress on those standards. Part of that student progress that we see relates directly back to if teachers know the standards, are incorporating the standards into instruction, and if that has an impact on student achievement.

Minnesota schools take the MCA tests in grades three, eight, ten, and 11 for math, science, and English language arts in the spring. The tests are based upon the Minnesota state standards. The official results from these tests are not given to the schools until the fall of the

next year and most results are proficiency percentages from the tests (see Appendices A and C). The Minnesota Department of Education recently started releasing benchmark reports that give schools grade level progress on the standards that are tested. The benchmark reports from the MCA-III tests are standard specific student achievement data because each report gives districts achievement data on if each grade level is achieving their expected results on each specific standard tested. Districts are given access to proficiency reports and growth as a district. They are given access to the benchmark reports through Pearson Access Next (2018) the next fall after taking the tests.

In Minnesota, the student achievement data that has been provided are proficiency reports from the state. The reports provide individual proficiency scores of students and classes as a whole in each subject. Benchmark reports with standard specific student achievement data is now available and consists of grade scores based upon specific standards. In Minnesota, benchmark reports are available for grades that take the MCA. These are English language arts in grades three through 8, and 10, math in grades three through eight, and 11, and science in grades five, eight, and 10–11. The state now provides access to data that are standard specific and not just an overall proficiency level (see Appendix B). The data makes clear whether specific grades are meeting projected school performance on specific standards. With access to this data and the use of it through data-based PLCs, what are the impacts on teachers' knowledge of standards, incorporation of standards into instruction, and their impact on student achievement?

Purpose of the Study

As an educational leader, the researcher was aware that the responsibility of student achievement is placed upon leaders' shoulders. Educational administrators in many levels have to lead staff on implementing best practices to improve student achievement. Researching this

topic will help explore the relationship between standard specific student achievement data and its impact upon teachers' standards knowledge, implementation, and student achievement. The researcher believed this project will impact future research on the type of data that educational organizations can provide to improve instruction and student achievement to ensure instructional improvement and continuous student academic achievement. By determining the type of data that can be impactful, the research can impact legislation, policy, and practice.

Hypotheses

For purposes of this study, the researcher sought to disprove the following null hypotheses:

1. Participation in PLCs has no impact on teachers' knowledge and incorporation of standards into instruction.
2. Increased teacher knowledge and incorporation of standards into instruction does not result in increased student knowledge.

In consideration of the null hypotheses, the alternative hypotheses are:

1. Participation in PLCs has a positive impact on teachers' knowledge and incorporation of standards into instruction.
2. Increased teacher knowledge and incorporation of standards into instruction results in increased student achievement.

To address the hypotheses, the researcher investigated two research questions.

Research Questions

Within the context of PLCs (data-based teams) utilizing standard specific student achievement data to examine teacher knowledge and incorporation of standards into classroom instruction and learning:

1) What impact, if any, was the use of PLCs on the teachers' knowledge and incorporation of standards into the classroom setting?
2) Did student achievement on standardized tests improve as the result of the level of teacher knowledge and incorporation of standards into the classroom?

The researcher tried to find if the standard specific student achievement scores impacted how well teachers know the standards and if they incorporated them in instruction. The impact of the data use PLCs was found by surveying teacher opinions of their knowledge of standards and instructional before and after they had participated in standard specific student achievement score use through PLCs. The survey took place after the district had participated in the PLCs for five years, some teachers did not participate for the full five years. The researcher used the differences in the knowledge and incorporation of standards to correlate student achievement scores to teachers who had high or low knowledge and incorporation through a Pearson's correlation. Once knowledge and incorporation have been measured the question was whether teachers viewed the use of standards specific achievement scores in PLCs as impactful on student achievement. Teacher opinion was also used through survey questions to find if teachers felt standard specific student achievement scores PLCs had an impact on student achievement. The opinion of the PLCs was also correlated to student achievement using a Pearson's correlation. Finally, student achievement scores were used from before the PLCs took place and

in the final year, they were available find if there was a statistically significant different between student achievement in the district before and after PLCs.

Definition of Variables.

The following are the variables of study:

Variable A: Teachers' knowledge level of standards.

Variable B: Teachers' level of incorporation of state standards into instruction.

Variable C: Level of student achievement.

Significance of the Study

In the past, the only achievement data provided by the Minnesota Department of Education were the proficiency levels of the students in particular subjects for particular grades. Different scores were provided for categories, but not the individual benchmarks. For example, a district would receive a proficiency level for fifth grade students for English language arts as stated as: 53% of students in fifth grade were proficient in English language arts (see Appendix B). Schools did not receive student achievement data on the individual standards or the benchmarks on which the tests were designed, but only the overall subject. Please see Appendix A for an example of a sixth grade English proficiency report.

The Minnesota State Standards are comprised of different standards and benchmarks for each grade level and subject area. As an example, a specific standard for the Minnesota State Standards (2019) for English language arts for grade six in literature is labeled 6.4.1.1. That standard requires student to read closely to determine what the text means explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. The benchmark on which that standard is tested on through the

MCA is to: Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

The benchmark reports are coded as to whether grades in that school reach that grade's expected performance on the specific benchmark. Please see Appendix B for a benchmark report that shows the levels of state performance, expected performance of grade, and actual performance. This data over time can show patterns of grade level performance on specific standards.

The original proficiency data given equates to giving a student a spelling test and only telling the student whether they passed the test, not the individual words in which the student showed mastery. Please see Appendix C for a proficiency report that shows the level of proficiency. How is a teacher or student supposed to improve instruction and student achievement of the standards with only the overall score of the test and not how students did on individual standards or benchmarks? The standards specific student achievement data, which are called benchmark reports in Minnesota on the MCA-III and MTAS, detail the progress of grade levels of each district on the specific standards or benchmarks on which they are tested. The release of the benchmark reports raises an important question that the researcher feels must be answered. What is the impact of using standards specific student achievement data on standards knowledge of teachers, level of incorporation of standards into instruction, and student achievement of the Minnesota state standards?

Permission and IRB Approval

In order to conduct this study, the researcher was approved through MSUM's Institutional Review Board (IRB) approval to ensure the ethical conduct of research involving human subjects. Likewise, authorization to conduct this study has been approved through the

previous superintendent when the research began. The researcher is the current superintendent and has been given approval through the school districts school board.

Informed Consent

Protection of human subjects participating in research will be assured. Participants will be informed of the purpose of the study via the Method of Consent (see Appendix D) that the researcher will read to participants before the beginning of the study. Participants will be aware that this study is conducted as part of the researcher's Doctoral Degree Program and that it will benefit his teaching practice. Confidentiality will be protected through the use of pseudonyms (e.g., Teacher 1) without the utilization of any identifying information. The choice to participate or withdraw at any time will be outlined both verbally and in writing.

Limitations

The limitation of the study involves the role of the researcher as the supervisor of the employees. Being in a position of authority could impact the feedback given by the teachers on the survey. The survey was administered electronically, and it was anonymous. However, grade level was used to calculate average proficiency of class, which skewed the anonymity of the survey.

Conclusions

The increased emphasis of legislation on schools to show progress through standardized testing has brought about a system in which data use is expected for continuous improvement. The state of Minnesota has implemented academic standards for student learning and a system through the MCA-III test that are intended to measure student progress. In the past, proficiency levels have been the unit of measurement that have been used to measure student progress. Recently, benchmark reports are a new source of data that have been released for district use.

This new form of data in the state deserves an in depth look to see if this data type is impactful in multiple areas.

There is research that details successful data use and PLCs. Nabrs Olah et al. (2010) has shown that when using interim assessments teachers linked that data to standards and adjusted instruction based upon that data. Bulkley et al. (2010, p. 203) asserted that school-level information about how test items link to content standards is meaningful when provided to teachers, principals, and administrators. Limited research has shown that teachers are increasing their instructional alignment to standards. There is a lack of research into the topic of teachers' knowledge of standards they are supposed to be teaching. There is also a lack of research on impactful data types.

Educators are in a system in which data use is expected and we need to find the most efficient and effective ways to use data. If the researcher can detail the impact of the new form of data made available, that research can impact practice, policy, and legislation. The Minnesota Department of Education's (2019) stated purpose of the Minnesota state standards is to "identify the knowledge and skills that all students must achieve by the end of a grade level or grade band." Measuring if students have achieved the knowledge and skills from the standards is attempted through the MCA-III. According to the Academic Standards (2019), the purpose of the MCA-III and MTAS is to "help districts measure student progress toward Minnesota's academic standards." The progress is being measured by the MCA-III but is the data from that measurement an impactful tool for teachers to use in data-based PLCs that impacts their knowledge of the standards, their incorporation or alignment of standards into instruction, and student achievement based upon those standards?

CHAPTER 2: Literature Review

Introduction

This study aims to explore the impact of teachers' study and utilization of standard specific student achievement data on those teachers' incorporation of standards into instruction, their knowledge of standards, and subsequent student achievement. There are six factors of this study that needed to be explored through previous literature, which are history of legislation concerning education, conditions of successful PLCs, successful use of data in PLCs, teachers' incorporation of standards in instruction, teachers' knowledge level of standards, and standard specific student achievement. This literature review will provide a brief overview of these six topics then discuss the interconnectedness of and supporting research for the topics.

Definition of Terms

The terms used in this study are commonly used in by the Minnesota Department of Education, Pearson Access Next (2018), Penuel, Fishman, Yamaguchi, & Gallagher (2007), Karr, Marsh, Ikemoto, Darilek, and Barney (2006), and Bulkley et al. (2019). Some terms are specific to Minnesota K-12 education. Some terms have similar definitions but were used for the purpose of comparing previous studies with the current study.

- *Benchmark Report*- Student achievement data to help identify possible gaps in instructional content.
- *Data Based Decision Making*- The process of making organizational decisions based on data rather than intuition or observation.
- *Instructional Alignment*- Alignment of curriculum, instruction, and assessment in a learning environment.
- *Interim Assessment*- A test administered at different intervals to check student progress.

- *MCA-III*- The Minnesota Comprehensive Assessment that help districts measure student progress towards Minnesota's academic standards and meet the requirements of the Elementary and Secondary Education Act.
- *MTAS*- Minnesota Test of Academic Skills is the statewide test that students who receive special education services and meet eligibility criteria take instead of the MCA-III.
- *NWEA*- Northwest Evaluation Association that provides assessments and student achievement data.
- *Professional Learning Community (PLC)*- A group of educators who meets regularly to share expertise collaboratively to improve instruction skills and increase student progress.
- *Standard Specific Student Achievement Score*- Student achievement scores that directly link to a specific academic standard.
- *Standards*- Academic standards are measures that define what students should know and be able to do at specified grade levels beginning in kindergarten and progressing through grade twelve.
- *Student Achievement*- The measure of academic content a student learns in an amount of time.

Different studies refer to different terms in different ways. Standard specific student achievement data is any data that can be linked back to one singular academic standard. There are many different types of assessments and student achievement data. Interim assessments are assessments that are done periodically throughout the year to measure student progress. The data from interim assessment can be standard specific or not standard specific. Benchmark reports are referred to differently in different studies. The benchmark reports for the MCA-III and MTAS are standard specific student achievement data. Some studies in the literature refer to benchmark reports that may not be standard specific student achievement data. Although, the

terms are used in different ways the author uses the term standard specific student achievement for any student achievement scores that connect to a specific standard.

Education Legislation

The Elementary and Secondary Education Act was first major piece of education legislation was established by Lyndon B. Johnson in 1965. This legislation was altered to have a strong focus on standards and accountability with the signing of No Child Left Behind (NCLB) in 2002 by President George W. Bush. Flexibility for standards and accountability was given back to individual states with the signing of The Every Student Succeeds Act (ESSA) in 2015 by President Barack Obama.

President Lyndon B. Johnson signed the Elementary and Secondary Education Act (ESEA) into law in 1965. The purpose of the law was to offer grants to districts serving low-income students. Grants were also provided to state agencies to improve education for elementary and secondary education.

President George W. Bush signed the No Child Left Behind Act (NCLB) into law on January 8th, 2002. The NCLB act required states to establish state academic standards, a state testing system based on the standards, and an accountability requirement called Annual yearly progress. The accountability requirement required schools to make annual yearly progress for all students. Schools that did not meet annual yearly progress were designated schools in need of improvement and were required to develop a two-year improvement plan. NCLB had a strong focus on standards, assessment, and accountability.

Schools that did not meet annual yearly progress could have specific actions done with the school to improve. If a school did not meet annual yearly progress for two years students were allowed to transfer to other public schools in the district and the district had to provide

transportation. Continued failure resulted in the district being required to offer supplemental educational services, replacing low performing staff, and creating entirely new curricula. Continued failure to meet annual yearly progress could result in replacing all or most of school staff, local control of the school being forfeited, or other major restructuring. This system was drastic shock to many districts and in 2015 an update to the law was enacted.

President Barack Obama signed the Every Student Succeeds Act (ESSA) into law on December 10, 2015. The signage of this law reauthorized the United States national education law. The ESSA act focused on reforming NCLB and giving states flexibility for some portions of NCLB in exchange for comprehensive state plans designed to close student achievement gaps, improve instruction, increase equity, and increase outcomes for students. The ESSA act had a few primary areas of focus. According to the United States Department of Education (2020) ESSA was aimed at six categories:

A. Advances equity by upholding critical protections for America's disadvantaged and high need students.
B. Requires—for the first time—that all students in America be taught to high academic standards that will prepare them to succeed in college and careers.
C. Ensures that vital information is provided to educators, families, students, and communities through annual statewide assessments that measure students' progress toward those high standards.
D. Helps to support and grow local innovations—including evidence-based and place-based interventions developed by local leaders and educators.
E. Sustains and expands this administration's historic investments in increasing access to high-quality preschool.

F. Maintains an expectation that there will be accountability and action to effect positive change in our lowest-performing schools, where groups of students are not making progress, and where graduation rates are low over extended periods of time.

According to the Minnesota Department of Education (2019) Minnesota addressed the requirements of the ESSA legislation:

> The Minnesota Department of Education submitted the state Every Student Succeeds Act (ESSA) plan to the U.S. Department of Education (USDE) on September 18, 2017, for review and approval. Some sections were resubmitted with edits, as requested by U.S. Department of Education, on January 3, 2018." The main portions of the Minnesota Department of Education Executive Summary outline. (p. 1)

The Minnesota state plan addresses assessment, which will occur in Minnesota Public Schools for the same grades and subjects under the NCLB. The Minnesota Department of Education addressed the provisions of ESSA Minnesota State Plan Executive Summary (2017).

> Minnesota will continue to administer the Minnesota Comprehensive Assessments (MCA) and Minnesota Test of Academic Skills (MTAS). These assessments are aligned to the most recent version of Minnesota's Academic Standards. The current assessments have been submitted to peer review. When Minnesota's Academic Standards are revised the MCA and MTAS will be aligned to the most recent version. (p. 5)

Accountability is also a factor in the ESSA legislation. The Minnesota Department of Education addressed the requirements of ESSA through its state plan regarding accountability. The state plan has two components in the World's Best Workforce and the state ESSA plan. Accountability measures in the Every Student Succeeds Act Minnesota State Plan Executive Summary (2017) are described as:

> Minnesota's accountability system sets a high bar to close opportunity and achievement gaps. The system focuses on ensuring all students, including students with disabilities, students in poverty, English learners, students of color and American Indian students are successful. It holds every school in the state accountable for the performance of every student group. Accountability indicators are publicly reported for all schools and disaggregated at the student group level. Schools will be identified and prioritized for support based on need. (p. 6)

The Minnesota Department of Education also established accountability goals for the state. The goals were outlined in the Minnesota state ESSA plan and provide a framework for the student achievement goals the state has set for itself to meet ESSA requirements. The following goals for student achievement are stated in the ESSA Minnesota State Plan Executive Summary (2017):

> ESSA asks states to describe ambitious long-term goals which include measurements of interim progress toward meeting the goals for all students and separately for each student group. 90 percent of all Minnesota students will be proficient in reading and math by the year 2025. We target achievement gaps with our goal of ensuring that at least 85 percent of students in every student group are proficient. 90 percent of all Minnesota students will score proficient or higher in reading by third grade, with no student group below 85 percent, by the year 2025. 90 percent of all Minnesota students will score proficient or higher in math, with no student group below 85 percent, by the year 2025. (p. 6)

The accountability goals play a factor in what happens if schools do not make accountability goals. According to the ESSA Minnesota State Plan Executive Summary (2017) schools are identified for support through a variety of factors:

> Minnesota will also use a stage-based decision process to find those schools that are low across all indicators. The process first checks school performance on the academic indicators, including academic achievement, English language proficiency, academic progress and graduation rates, and lastly, the process evaluates every school's consistent attendance rates. (p. 7)

Federal legislation has outlined goals and processes states have to follow. Minnesota has created a state plan to address the requirements of the Elementary and Secondary Education Act, No Child Left Behind, and the Every Student Succeeds Act. The Minnesota State Plan outlines specifically the goals, how those goals are assessed, and the accountability measures if those goals are not met. Karr, Marsh, Ikemoto, Darilek, and Barney (2006) detailed how the legislation has created an environment in education that requires districts to monitor progress on standards and hold districts accountable. The legislation and policy from federal legislation and the Minnesota State Plan to address the legislation has created an environment in which districts have goals, those goals are assessed, and accountability measures are in place if those goals are not met.

Overview of the Literature

Broadly, the existent literature is thorough regarding the successful conditions in PLCs and successful data practices. The research is less thorough regarding teachers' incorporation of standards into instruction and knowledge of standards. There are links between successful PLCs and how they impact student achievement. There are also links between data use and student achievement. The research is limited in showing the impacts of the incorporation of standards into instruction or teachers' knowledge level of standards on student achievement. There is a thorough history of education legislation.

The first theme of the literature review is establishing the successful conditions of PLCs. Research was needed to identify foundational conditions of successful PLCs. The success of a PLC may be increased by incorporating these conditions. Identifying successful PLC conditions can give a baseline of what needs to occur in PLCs in order for the process to be successful. Three themes of successful PLCs and professional development were established as collaborative, ongoing, and focused (Penuel, Fishman, Yamaguchi, & Gallagher 2007, Templeton and Willis 2017, Ruchti, Jenkins, and Agamba 2013, Goddard and Goddard 2007).

The second theme of the literature review is successful data use in PLCs. The literature provided a baseline of what conditions are present in successful use of data. There is a large portion of data based decision making research that takes place in the Netherlands. Poortman and Schildkamp (2017) discovered that Dutch schools have a great deal of autonomy in their selection of curriculum, methods, instruction, and assessments. This autonomy helps to identify impactful types of data, data use processes, and other factors impacting data use. The research established successful conditions for the use of data. These conditions may be incorporated into a model outlining the steps to a successful data centered PLC. According to Poortman and Schildkamp (2017) the three areas of successful data use were specific, timely, and collaborative.

The third theme is the dependent variable of teachers' incorporation of standards into instruction. The literature identified that teachers' instructional alignment is increasing, but by a small amount, however the literature is limited. Although alignment is increasing since the introduction of standards Polikoff (2012) noted that increases are "small to moderate in magnitude" (p. 362). The literature has detailed that utilizing standard specific student achievement data can help teachers identify standards to increase instructional alignment to standards.

The fourth theme is teachers' knowledge level of standards. There was a dearth of literature of the knowledge level of standards by teachers. There is literature on the view of standards by teachers, but not if they know the content of those standards. Some research has identified that training and understanding standards gives teachers a better overall view of the standards but does not detail the depth or extent of their knowledge of the standards. (Bailey 2010, Ruchti, Jenkins, & Agamba 2013)

The fifth theme is student achievement in which the literature identified data-based decision making, PLCs, instructional knowledge, and instructional alignment had an impact on student achievement. (Van der Scheer and Visscher 2017, Lai & McNaughton 2016, Goddard and Goddard 2007) The impact that these areas had on student achievement was a point of dissention with some areas having only weak statistical evidence of impact and other themes dependent on external factors in order to have an impact. Many variables are present and are hard to account for when analyzing student achievement.

Professional Learning Communities

There is expansive research about different professional development concepts for teachers. There are many ways that professional development can be positively impacted. Three main themes emerged when looking at successful professional development. Professional development that is collaborative, ongoing, and focused was found to be effective. For example, Penuel, Fishman, Yamaguchi, & Gallagher (2007) stated the importance of "teachers' having meaningful, ongoing, and coherent professional development experiences that were consistent with their local school and district goals" (p. 945). The study used a sample of 454 teachers in a science program. The authors used data from 28 different professional development providers to find teacher perceptions of what were effective professional development practices. The main

themes emerge when looking at successful professional development. Professional development that is collaborative, ongoing, and focused was found to be effective.

There has been research on conditions of successful PLCs. Templeton and Willis (2017) conducted a study on establishment and sustainability of PLCs in a study done in Texas in rural schools. The qualitative study included seven principals with at least three years of experience in West Texas. Templeton and Willis (2017) discovered a few factors that were important for successful PLC's: teacher leadership, gaining teacher trust, and collaboration time. Collaboration is an important factor that has been shown to be important for successful PLCs especially in rural schools. Templeton and Willlis (2017) stated "that being small rural schools did not provide teachers with much free time, as many were the only teachers in their departments or subject areas" (p. 34).

Specifically, Ruchti, Jenkins, and Agamba (2013) found that teachers identified the importance of having opportunities to collaborate while implementing the standards. The quantitative study used more than four hundred and fifty teachers from twenty Idaho school districts implementing Common Core Standards. The study surveyed teacher beliefs of professional development through PLCs that were aimed at implementation of standards. Ruchti, Jenkins, and Agamba identified that "a powerful insight was that 98–99 percent (strongly agree and agree) of respondents indicated that their priority was collaborative time with other teachers" (p. 86).

Throughout the research, collaboration was not limited to teacher-to-teacher interactions. The importance of collaboration with school leaders was emphasized as well. According to Anderson, Leithwood, and Strauss (2010), "school data use was a collective activity involving principals working with their teachers in those schools where we observed what seemed to be the

most intensive and potentially productive patterns of data use for improvement in student learning" (p. 322). There are many ways to use data in a school, but one condition that can help it be successful is principals working with teachers and data. The literature leans in the direction of successful conditions like collaboration with leadership having a positive impact on student achievement.

The literature clearly showed that teacher collaboration can have a positive impact on student achievement whether it happens in or outside PLCs. In 2007, Goddard and Goddard conducted a study of 47elementary schools in one large midwestern school district. The study used empirical research to measure the naturally occurring differences in teacher's collaboration and its impact on student achievement. Goddard and Goddard (2007) found that "teacher collaboration for school improvement was a significant positive predictor of differences among schools in student achievement" (p.890).

Likewise, Goddard, Goddard, Kim, and Miller (2017) showed the link between school leaders' impact on teacher collaboration and student achievement. The study utilized data from a school leadership improvement study, which was a large-scale, longitudinal study of a balanced leadership program. Surveys were distributed to 93 elementary schools in high poverty areas in the Midwest United States. According to Goddard et al. (2017), "our results demonstrate that both principals' instructional leadership and teacher collaboration for instructional improvement are important indirect predictors of differences among schools in student academic achievement" (p. 525).

Collaboration has been shown to impact teacher performance and student achievement whether through PLC's or not. Schildkamp and Kupier (2010) conducted an explorative quantitative study of six schools in the Netherlands that detailed data use and its purposeful use.

Schildkamp and Kupier (2010) found that “lack of teacher collaboration may be a hindering factor in the use of data” (p.4 95). Collaboration among teachers and administrators creates communication between groups. This communication and collaboration are important for using the data impactfully and improving instruction.

Data Use

There has been research that has identified impacts of standard specific student achievement scores on teacher instruction. Nabrs Olah, Lawrence, and Riggan (2010) found that teachers used interim or progress monitoring assessment data to identify areas of emphasis and linked the reports to state standards. If the interim data reports were not showing progress then teachers adjusted instruction. Interim data reports have shown impacts in these areas, but research has not detailed the impact on teachers’ knowledge of standards, standards instruction, or student achievement.

In a qualitative study in Philadelphia school districts Bulkley, Christman, Goertz, and Lawrence (2006) detailed the use of interim assessments. The study focused on benchmark reports as tools to guide teachers in instruction. Bulkley et al. (2006) found that benchmark reports fulfilled an “evaluative purpose by providing teachers, principals, and administrators with school-level information about how test items link to content standards can be meaningful tools for teachers” (p. 203). The research delved into benchmark reports but is limited in detailing the impact on teacher knowledge of standards, instruction of standards, and impact on student achievement. The literature does not give an overall picture of how benchmark reports impact these areas.

The successful use of educational data is a process that is performed in many different formats across many different systems. There is research detailing successful data review

practices and barriers to successful data practices. Poortman and Schildkamp (2016) found that conditions of organizations with successful data teams included access to high quality data, school leadership participation and support, having a shared goal, and collaboration. The qualitative study was conducted in the Netherlands with four data teams in six different schools in upper secondary levels. The study outlines that the successful teams had those characteristics whereas unsuccessful teams encountered barriers.

Another study in the Netherlands detailed the type of data that educators find to be useful. In a quantitative study that used teachers from 1339 different secondary schools Ebbler, Luyten, Poortman, and Schildkamp (2017) detailed what makes data impactful. Ebbler et al. (2017) detailed that factors that make data impactful are accessibility of timely data, usability, and quality of data. There were also conditions of organizations that made data impactful as well. Ebbler et al. (2017) stated that organization factors that make data use successful were vision and norms, leadership, support, and collaboration. These factors establish what elements of successful data need to be present for the data to be successful.

Karr et al. (2006) conducted a study of three urban school districts with over 9,000 teachers. The study researched the impacts of strategies for data use in instructional improvement. The study also used one district in which standard aligned interim assessments were used, Karr et al (2006) found that the “majority of principals and district staff interviewed found interim assessment data valid and useful and reported using the system regularly” (p. 509). This factor is important because it indicates that standard aligned interim assessments are considered a quality type of data. The researchers also found that there were barriers to successful data use. Karr et al. (2006) found that low human capacity has been a barrier to successful data use. Data can be reviewed for school improvement, instruction, or accountability

purposes, but the knowledge, skills, and attitudes regarding data procedures of the people using the data are also an important factor.

Successful data teams have similar conditions that help make them successful. Karr et al. (2006) illustrated the importance of human capacity when they found successful data teams were enabled by long-standing state accountability systems, accessibility and timeliness of data, teachers' views of the assessment results as valid measures of students' knowledge and ability, and the degree to which school staff received training and support for analyzing and interpreting data. When people are trained in data use and know how to use it then it can be impactful.

Conditions for successful data use were also noted by Farrel and Marsh (2016) who found that data teams needed to be ongoing, have dedicated time, and leadership must be supportive and involved. The comparative case study was conducted in six schools in four districts who were purposefully selected as those were schools who were implementing data-based decision making. Farrel and Marsh (2016) stated that "conversely, a lack of time, training, and leadership frequently inhibited this work" (p. 282). The research has shown the conditions for successful data teams to take place and the barriers for successful data use.

There are many barriers to successful data use. Poortman and Schildkamp (2016) detailed that in order for data to be successful in impacting instruction the user needs to have the knowledge and skills to use the data and the disposition to use data. Successful data use is impactful when successful conditions are present and those using the data have appropriate skills and attitudes toward the data itself.

Schildkamp and Kupier (2010) found that "teachers seemed to be mostly interested in data at the classroom level" (p.494). Collaboration in data use is important, but the type of data is also important. Classroom data is specific to the teachers, who then find the data more useful.

Standard specific data then links this to what the teachers are supposed to be teaching. Quality data has been a factor noted that is an important factor for successful data use. This shows that teachers need data that is linked to their specific classrooms.

Instructional Alignment

The research regarding the use of data has helped to increase instructional alignment. According to a study by Polikoff (2012), "studies generally indicated that 80-90 percent or more of teachers across states, grades, and subjects reported increases in instructional alignment over time" (p. 362). Although alignment is increasing since the introduction of standards, Polikoff (2012) noted that increases are "small to moderate in magnitude" (p. 362). There is a wide range of instructional alignment across our country. Polikoff and Porter (2014) found that "the alignment of teachers' instruction with state standards and state and alternate assessments is low" (p. 405). We don't know how well teachers know standards or how well they are aligning them to instruction.

Poortman and Schildkamp (2016) found that teachers used data only a small amount for instructional purposes. There has been a wide variety of different uses for data. There is not a clear consensus for the purpose for data in different schools but improving instruction or instructional alignment has not been a main outcome of data teams. Shildkamp (2019) found schools seem to be making greater use of data for accountability and school development than for instructional purposes. There has been a push for accountability and the data types are a direct relation to that purpose.

Contrary to Poortman and Schildkamp (2016), Nabrs Olah et al. (2010) asserted that the use of standard specific student achievement scores or benchmark reports might focus on how data can be used for instructional alignment. Nabrs Olah et al. (2010) found that when using

interim assessment data, teachers used the reports to identify areas of emphasis, linked the reports to state standards, and if benchmark reports were subpar not then teachers changed instruction. The standard specific student achievement data seems to have a purpose not in accountability, but in improving student achievement and teacher instruction by means of instructional alignment.

Opfer, Kaufman, & Thompson (2017) pointed out a caveat to teachers' using achievement data to improve instruction: Teachers must be willing and able to engage in the time-consuming work to change their instructional practice to address newer standards and instructional resources aligned with those standards. There are many variables that come into play for impactful instructional alignment from data. Teacher willingness and efficacy is an important factor in instructional alignment. If a teacher doesn't feel the standards are important or valuable, that teacher may not allocate instructional time and effort on those specific standards.

Instructional alignment is an important factor in learning and student achievement. It's not just the alignment of the instruction to the standards that can have an impact, but the alignment of the assessments as well. Polikoff, Porter, and Smithson (2011) found that "the results clearly indicate that the standards and assessments in the observed states are not as well aligned as they could or were intended to be" (p. 991). The study analyzed standards and standardized assessments in 19 states. The alignment of the standards to the assessment can have an impact on student achievement, just as teacher alignment to the standards can have an impact on student achievement. Polikoff, Porter, and Smithson (2011) found that "while most tests have relatively small proportions of content in complete misalignment with standards, few have no such content, and some have at least half of test content in complete misalignment" (p. 991). We

must recognize that these factors can have compounding impacts. Imagine a spelling test in which the teacher teaches only 75 percent of the words on the test, how well will the students perform if they only know 75 percent of the content?

Knowledge of Standards

The breadth of research of teachers' knowledge of standards is not significant. There is a wide variety of standards throughout the United States and internationally. Many states have adopted versions of the Common Core standards. Two studies outlined teachers' perceptions of Common Core standards in different states than Minnesota after the implementation of the No Child Left Behind Act of 2002. Matlock et al. (2016) found that teachers have overall positive to very positive views of the standards and their implementation. Cochrane and Cuevas (2015) stated that "teachers did feel that the new standards would be better at preparing students for college and/or a career, and that they would also help to improve students' higher-level critical and creative thinking skills" (p. 20).

There has also been research that has outlined how state standards impacted teaching and teachers' perceptions of standards themselves. Donnelly and Sadler (2009) showed that implementing state standards were generally "counterproductive for teachers and students" (p. 1063). However, positive views were noted by Donnelly and Sadler (2009), that standards helped to define content to be taught. Donnelly and Sadler (2009) provided an overall view of the standards being important or not, but views of the positive and negative aspects of the standards. Cochrane and Cuevas (2015) found that "the more prepared, trained, and informed teachers felt about the new standards, the higher they rated them" (p. 17).

Coming full circle to the earlier discussion regarding professional development (see pp. 18–21), there has been research that has shown standards based professional development has

increased teacher's ability to prepare impactful instruction (Ruchti, Jenkins, & Agamba, 2013). According to Bailey (2010), "Involving teachers in sustained standards-based professional development aimed at increasing their content and pedagogical knowledge improves their ability to prepare and use effective instruction" (p. 130). The study by Bailey (2010) used professional development that immersed teachers in individual standards. If the teachers understand the content better, they can prepare more effective instruction. Although the study showed that by analyzing individual standards, teachers are more prepared, it did not link this preparation or implementation to student achievement.

Student Achievement

One such study illustrates a change in practice or an intervention. In a Dutch study that used grade four teachers in 60 primary schools, Van der Scheer and Visscher (2017) investigated the impact of data-based decision making on math achievement in grade four. Van der Scheer and Visscher (2017) found that "although no intervention effect on mathematical achievement was found across all students, the students in the extended instruction group benefited considerably from the DBDM[data-based decision making] intervention" (317). The researchers found that all students did not benefit from DBDM, but the group of students with extended time did. The variety of data used does not provide a clear picture of a type data that has a successful impact on student achievement.

There have been varying results as to whether data-based decision making has an impact on student achievement. There is little evidence that data alone changes student achievement, but the processes associated with the use of data is what has an impact. In a mixed methods study of 183 schools and 43 districts Anderson, Leithwood, and Strauss (2010) researched the relationship between student achievement and data use. Anderson, Leithwood, and Strauss,

(2010) found weak statistical evidence of positive relationship between student achievement and district or school data use in the quantitative aspect of the study. The qualitative study produced some different results. In the qualitative portion Anderson, Leithwood, and Strauss, (2010) noted that " the potential for these focused improvement plans to make a difference in the quality of student learning is highly dependent on the degree to which local educators are able to align local curriculum and teaching and assessment practices with the external measures against which they are being held to account" (p. 321). The research is detailing that it is not the data use, but the actions which take place with the use of data that has an impact on student achievement.

Another study confirming this view was conducted by Lai & McNaughton (2016) who stated, "that the data use PD made a significant contribution to improving student achievement, but we cannot attribute the achievement gains solely to the data use PD" (p. 440). The quantitative study took place over eight years in 53 schools and detailed the impact of data use professional development. The impact of data use on student achievement might be through the practices that data use changes.

To underscore the interconnectedness of student achievement, data practices, PLC's and instructional alignment, successful practices in PLCs can have an impact on student achievement. Goddard and Goddard (2007) found that "teacher collaboration for school improvement was a significant positive predictor of differences among schools in student achievement" (p.890). Collaboration was seen as an important factor among teachers and is also an important factor in student achievement.

Furthermore, Squires (2012) noted when instruction and assessment were aligned during sample lessons, both low- and high-aptitude students scored well on curriculum-embedded tests. If we are teaching the content that students are tested on, then they will do better than if we do

not teach what's on the test. The alignment of the assessments through standards and data review could be a direct link to higher student achievement.

There are many variables that impact student achievement such as instruction, alignment, teachers' knowledge of standards, curriculum and many other factors. Polikoff and Porter (2014) noted that "it is possible that pedagogical quality and instructional alignment would interact to affect student achievement - for example, alignment affects student achievement more strongly when pedagogical quality is high" (410). The variables can interact with each other, impact each other, and impact student achievement.

Conclusions

There is an ample amount of research on PLCs and data use in education. There is a limited amount of research on instructional alignment, teacher knowledge of standards and the connection to student achievement. The research documented the conditions that make a successful PLC which are the amount of support by administration, that they are collaborative, are regular and ongoing, and many other factors. The same conditions emerged for successful data-based decision making teams. These conditions help define how to run successful PLCs and data-based teams.

The research is less clear when it comes to instructional alignment, teachers' knowledge of standards, and student achievement. There has been a strong push towards standards-based education and the use of data from standardized testing to show progress from policy and legislation. The research does not provide a clear view of the impact of this push on teachers and students. How teachers use the data has been documented, but not the impact of specific types of data used. There are still varying views of the impact of standards and data on both instruction and student achievement from the teacher perspective.

A clear view of the conditions necessary for successful PLCs and data-based teams has been made through the review of the literature. What has not been shown is the impact of PLCs and data-based teams using standard specific student achievement data on teachers' knowledge of standards, incorporation of standards, and student achievement. The findings from the research questions in this study will help fill this gap in the literature.

CHAPTER 3: Methods

Introduction

This study explored the impact of PLCs focused on reviewing standard specific student achievement performance data and its impact on state standards incorporation in instruction, teachers' knowledge of state standards, and students' academic achievement. Using a positivistic paradigm and a quasi-experimental design the researcher used a survey and student achievement data to provide impacts of using standard specific student achievement data in a data based PLC. Research questions probed the teacher level of knowledge and incorporation of state standards before and after the data based PLCs. Student achievement data was correlated to the teacher level of knowledge and incorporation. The collection and analysis of data was done through descriptive statistics, a paired t-test, and a Pearson's Correlation.

Research Question

Within the context of PLCs (data-based teams) utilizing standard specific student achievement data to examine teacher knowledge and incorporation of standards into classroom instruction and learning:

1) What impact, if any, was the use of PLCs on the knowledge and incorporation of standards into the classroom setting?

2) Did student achievement on standardized tests improve as the result of the level of teacher knowledge and incorporation of standards into the classroom?

The two questions guided the survey. The first question was answered by teacher opinion of their own knowledge and incorporation. The second question was derived from the MCA-III test and teacher opinion.

Theoretical Framework

The researcher subscribed to findings that were put forth by Bulkley et al. (2010) who theorized that the use of interim assessments needed to have data that was focused on standards for teachers and students, and teachers needed time for collaboration and professional learning opportunities that used grade level teaming in order to be successful. The framework also had teachers use assessments to identify specific standards students were not mastering and finding strategies to change instruction for those standards. The quantitative study used teacher interviews to find what the successful conditions of interim assessments use are.

Research Design

The research utilizes the positivistic paradigm. According to Briggs, Coleman, & Morrison (2012) positivism is "where it is accepted that facts can be collected about the world; language allows us to represent those facts unproblematically; and it is possible to develop correct methods for understanding educational processes, relations, and institutions" (p.16). The researcher attempted to measure whether standard specific student achievement scores have an impact on specific areas of education. Using quantitative research in a positivism paradigm helps collect certainty on whether standard specific data types have an impact.

The researcher used Quasi-experimental/survey research. The processes of PLCs using data-based decision making with standard specific student achievement scores was already taking place for four years before the research began. Implementing a full experiment was not possible when examining the impacts after the processes have already taking place. Quasi

experimental/survey research was used because the researcher is also an administrator in the district. Using a survey allows anonymity for the participant with the researcher being in a position of authority. This was a quantitative study because the survey will connect with student achievement data. Connecting the achievement data with teacher responses was efficient through a quantitative study.

Setting

The study will be taking place in a small rural school in northwestern Minnesota. The district is made up of two towns with a combined population of 883. The towns have a heavy population of oil pipeline workers as there is an oil pipeline transfer plant in the larger populated town. The district has been known for its agricultural and industrial programs. The population of the school district is 470 students on average per year. There are 37 teachers employed by the school. According to the Minnesota Report Card (2019), the district has 52.1% of students who qualify for free and reduced priced lunches and 18.5% of students in special education. Furthermore, the demographics of the school's student body is: 13.4% American Indian, 1.9% Hispanic/Latino, .9% Asian, 1.1% Black/African American, 76.1% White, and 6.7% two or more races.

Participants

The participants were 33 teachers in the district who took the survey. The survey was on a volunteer basis. There were 26 teachers of the 33 teachers who can be linked to student achievement scores. Seventeen of those teachers had students with MCA-III scores. The MCA-III tests are taken in grades three through eight, and 10 for English language arts; grades five, eight, 10 for science; and grades three through eight, and 11 for math. NWEA tests are used in grades K through six for English language arts and math, but student achievement data was just

used for the K through grade two teachers as they do not have MCA-III student achievement scores. The teachers who do not have answers to student achievement data questions will be used for the overall study, but not correlated to student achievement data.

Sampling

The study used a convenience sample from the school district. A convenience sample was used because the specific school district has used PLCs with standard specific student achievement scores. The survey was used on a volunteer basis. The volunteer basis ensured that teachers were not coerced into providing feedback. The researcher was an administrator in the district and did want to have undue influence on who would take the survey. The district has 26 teachers whose classes use MCA scores or NWEA scores for student achievement data. All teachers have participated in PLCs of analyzing benchmark reports for the district as a whole.

Instrumentation

The researcher designed a survey that gathered demographic information, teaching grade level and subject, teaching experience, and questions on the three constructs of the study. The quasi-experimental study used SPSS, a paired t-Test, and a Pearson's Correlation to compare data and link student achievement scores. Student achievement was measured by MCA-III proficiency levels and NWEA proficiency levels.

The survey was designed because there was not an instrument available to measure the three constructs. The questions were tested for validity with six experts in the field of education. The alpha co-efficient for the study was .81. This was an average rate of reliability for the questions.

The questions started with demographic information asking age, race, and gender. The next section gathered information on content area, grade level, and teaching experience. The

experience level was gathered in five year increments. The content area and grade level allowed student achievement scores to be linked to the answers while maintaining anonymity.

The quasi-experimental study used a SPSS/t-test to compare data of teachers' knowledge of standards and incorporation of standards before and after PLCs with standard specific student achievement. This allowed the researcher to find if the data-based PLCs with standard specific student achievement had an impact on both teacher knowledge level and incorporation of standards. Level of knowledge and incorporation of standards were then correlated to student achievement scores of teachers through a Pearson's correlation. The achievement scores were MCA proficiency levels and NWEA proficiency level. Each grade has a proficiency level assigned after taking the test which describes how many students meet the requirements of the MCA or NWEA test based upon that grade level. Proficiency levels of each grade are provided in math, science, and English language arts for the MCA-III and English language arts and math for the NWEA. The achievement scores correlated to the level of knowledge of standards and incorporation into instruction.

Data Collection

The survey was administered through Google forms. The data was then transferred into SPSS. Multiple-choice questions were used for demographic information. The survey used a Likert scale ranging from 0–10 for the questions regarding teacher incorporation of standards and knowledge of standards. There were four questions on the teacher's opinion of the effectiveness of PLCs on improving instruction and student achievement. Student achievement scores were used from the MCA-III and NWEA tests. MCA-III scores are generated by Pearson, a company who provides benchmark reports for the MCA-III tests and through the MDE Report Card. NWEA student achievement scores are provided by the Northwest Evaluation Association.

The survey was administered during October of 2020. The student achievement scores were the achievement scores from years 2014-2019. Data from the MCAs were not available for the 2019-2020 school year because of the cancellation of tests in that school year due to the Coronvirus pandemic. MCA proficiency scores were not available for the current year of teaching. The teachers' grade level for the 2018-2019 school year was the information collected on the survey due to the lack of data for the 2019-2020 school year.

Data Analysis

Data analysis was done through using descriptive statistics, a paired t-test, and a Pearson's correlation. The survey used a Likert Scale based upon teacher opinion of their knowledge level and incorporation of state standards before and after PLCs using standard specific student achievement data. The t-test allowed the researcher to explore any statistically significant differences in teacher knowledge level and incorporation before and after PLCs. A paired t-test was also used to analyze district student achievement scores between 2014 and 2019 to explore and statistically significant differences. The Pearson's correlation correlated the teachers after scores in knowledge and incorporation to the 2017-2018 and 2018-2019 school years of student achievement scores. The Pearson's correlation was also used to find any correlation between teacher opinion of PLCs and student achievement scores.

Research Question(s) and System Alignment

Table 1 provides a description of the alignment between the study Research Question(s) and the methods used in this study to ensure that all variables of study have been accounted for adequately.

Table 1.

Research Question(s) Alignment

Research Question	Variables	Design	Instrument	Validity & Reliability	Technique (e.g., interview)	Source
RQ1	Teacher incorporation and knowledge of standards	Quasi-experimental	Survey	.81 Alpha Coefficient	Likert Scale	Teacher
RQ2	Teacher opinion of PLCs effectiveness	Quasi-experimental	Survey	.81 Alpha Coefficient	Likert Scale	Teacher
RQ2	Student achievement	Quasi-experimental	SPSS/t-Test/Pearson's correlation	.81 Alpha Coefficient	Data Analysis/Likert Scale	MDE

Procedures

Teachers voluntarily completed a survey in the fall of 2020. All PK-12 teachers in the district were asked to participate if they had been in the district in the previous year and had participated in PLCs. Student achievement scores were available for teachers who had students

who took the MCA-III or NWEA tests in the teachers' subject matter. Student achievement scores were used for the grade level and subject taught. Individual student scores will not be used.

The PLCs that consisted of the benchmark report review process consisted of approximately eight to10 one-hour sessions per year. The PLCs were conducted regularly throughout the year. The PLCs were comprised of large group sessions and then small group sessions of grade level teachers or subject teachers. The teams consisted of grade level teams for early childhood and elementary education. In high school there are approximately two teachers per subject, but the number of teachers in the teaming groups varied based upon subject. The teachers reviewed the benchmark reports in which the district did not meet expected progress and benchmarks in which the district exceeded state expected progress. The survey collected demographic information and measured teachers' incorporation of standards into instruction and teachers' knowledge of standards before and after the PLCs that they participated in. The survey is provided in Appendix D. The researcher used overall district proficiency scores in math, ELA, and science for the to find statistically significant differences before and after the PLCs.

Ethical Considerations

The researcher is the superintendent of the district studied and the supervisor of the teachers who participated. The researcher also helped design the processes used and the PLC structure. The researcher only included teachers on a volunteer basis. The participants were not required to do the survey. An explanation of how the data was used was given. The survey was anonymous although it reported grade level data, so that data can be correlated with student achievement scores. Some teachers did not participate in the survey and the reasons were unknown.

Conclusions

The study is aimed at finding the impact of using standard specific student achievement data through the theoretical framework established by Bulkley et al. (2010). Bulkley et al. (2010) identified conditions necessary for data use to be successful. Using quasi-experimental research with descriptive statistics the researcher has explored the topic through a positivism paradigm.

The study explored data-based PLCs that had dedicated time, collaborative time through grade level teaming, and specific standard instructional analyses that utilized standard specific student achievement scores. The PLCs which took place in a rural school in northern Minnesota used a convenience sample, on a volunteer basis to counteract any ethical considerations of the researcher being an administrator in the district.

Using the data-based PLCs the researcher aimed to answer the research questions of how standard specific student achievement scores impacted teachers' knowledge of standards, incorporation of standards in instruction, and student achievement. The questions were answered through a survey, data analysis using descriptive statistics, a paired t-test, and a Pearson's correlation. The student achievement scores were only be used for the teachers that they were available.

The study included teachers from a district who have used data-based PLCs with standard specific student achievement scores for the last five years and will continue with these data based PLCs. The impact of using standard specific student achievement scores will increase teachers' knowledge of standards, incorporation of standards into instruction, and student achievement. The study will show the impact of the data-based PLCs on teacher's and student achievement.

Chapter 4: Results

The purpose of this quantitative study was to explore the impact of PLCs with standard specific student achievement scores on teacher knowledge of academic standards, teacher incorporation of standards in instruction, and the impact of knowledge and incorporation on student achievement. The quantitative study analyzed a survey of teachers who participated in PLCs that focused on standard specific student achievement over five years. The study also used both NWEA and MCA-III student achievement scores from individual teachers to correlate the student achievement scores to teacher knowledge of standards and incorporation of standards.

Chapter 4 presents the findings of the research and addresses the research questions separately. Research Questions 1 and 2 were guided by the data from the survey, which measured teacher knowledge of standards through before and after questions of five types of standards knowledge and four types of teacher incorporation of standards. Student achievement data were used in conjunction with teacher survey data to analyze how knowledge and incorporation impacted student achievement. The findings are presented in three sections: demographic information and participant information, statistical analyses of the research questions, and a summary of the results.

The analysis of the paired t-test indicated that the knowledge level and incorporation level both showed statistically significant increases for teachers after participating in PLCs with standard specific student achievement scores. The paired t-test also showed statistically significant increases in student achievement scores from 2014 to 2019. There was also a small correlation between teacher incorporation of student achievement, a medium correlation between knowledge and student achievement, and a strong correlation between teacher opinion of

effectiveness of PLCs and student achievement. An interpretation of the findings and recommendations are presented in Chapter 5.

Participant Demographics

The survey was administered in September of 2020, in a PLC session in which teachers normally participate. The school district has 37 Pre-K through twelve teachers and 33 teachers responded to the survey. The teachers responding had varying years of experience: 42.4% of teachers had more than 20 years of experience, 9.1% had 15-20, 15.2% had 10-15, 27.3% had 6-10, and 6.1% had less than five years of experience. There was a relatively even split of teachers in different grade levels with 14 teachers in grades 7-12 and 19 teachers in grades Pre-k through 6. Respondents included 48.3% in the elementary, 12.9% in special education which serves Pre-K-through 12, 9.7% math, the arts and social studies both had 6.5%. There was a relatively large gender gap with twenty-seven of the thirty-three respondents being female. The age of the respondents was not diverse with 27.3% being over 50, 39.4% being 40-50, 24.2% being 30-40, and only 9.1% being 20-30. Experience participating in PLCs included 65.5% had participated for all five years, 12.5% for 4 years, 12.5% for 3 years, and 9.3% for two years or under.

This study analyzed data from a survey that was administered in September of 2020 to teachers who participated in PLCs on standard specific student achievement scores. The study also analyzed student achievement data from NWEA and MCA-III over a span of five years (2014-2019). Student achievement data was not available for the 2020 year because of the Covid-19 pandemic. The following is a review of the research questions that guided the study. Quantitative data for Research Question 1 were derived from teacher survey answers. Research Question 2 was answered through the use of teacher survey answers paired with NWEA and MCA-III scores.

Statistical Analysis

Research Question 1 Findings

RQ1: "What impact, if any, was the use of PLCs on the teachers' knowledge and incorporation of standards into the classroom setting?"

The first research question was answered by two separate sets of survey questions. The first set of survey questions asked the participants about their knowledge of standards in five areas: (KLGL) knowledge level of standards in grade level and content area, (KLGO) knowledge level outside grade level and content area, (KLCO) knowledge level of standards included in curriculum, (KLAG) knowledge level of standards in standardized tests in grade level and content area, and (KLAO) knowledge level of standards in standardized tests outside grade level and content area. The survey questions asked participants what their knowledge level was before and after the PLCs with standard specific student achievement.

The first research question was also answered by the second set of questions about incorporation of standards into instruction. Incorporation was in four areas: incorporation of standards into daily instruction (IID), incorporation of standards into daily lesson planning (IDLP), incorporation of standards into assessment (IA), and incorporation of standards into unit planning (IUP). The survey questions asked participants what their knowledge level or incorporation level was before and after the PLCs with standards specific student achievement scores. Knowledge level or incorporation before PLCs was signified by a (B) and knowledge level or incorporation after was signified by an (A). The difference of the before and after levels was noted as (difference).

The first research questions was looking for the difference of knowledge and incorporation before and after PLCs. Although the survey was not administered before teachers

took part in the PLCs, the survey analyzed the differences by asking teachers what their knowledge level was before PLCs and after participating in them. A paired samples t-test was used to measure the difference between knowledge and incorporation before and after the PLCs. This statistical method was appropriate because, "the paired-samples t-test is used to determine whether the mean difference between paired observations is statistically significantly different from zero" (Laerd Statistics, 2018).

The null hypothesis for the research question was, "Participation in PLCs has no impact on teachers' knowledge and incorporation of standards into instruction." The null hypothesis means that the paired samples t-test would show no statistically significant difference between knowledge or incorporation of standards. The dependent variable analyzed was the knowledge level of standards and the incorporation level of standards.

To identify outliers, the researcher used SPSS 26. SPSS was used to detect outliers for each subject within the constructs. SPSS found outlier scores for five of the nine areas measured. As there were only eight outlier scores detected in the data set for all the areas, the outlier scores were included in the data as inspection of their values did not reveal them to be extreme. Also, the outlier scores did not unduly influence the mean difference and while they did increase variability, they did not change the conclusion of the paired samples t-test. The boxplot charts for all the difference scores of the before and after survey are presented for review in Appendix E.

The Shapiro Wilks test of normality was run on the difference scores to determine if the data was normally distributed. This test of normality was used because, "the Shapiro-Wilk test is recommended if you have small sample sizes (< 50 participants) and are not confident visually interpreting Q-Q Plots or other graphical methods used to test for normality" (Laerd Statistics, 2018). The significance scores of seven of the nine categories of difference scores were shown to

be not normally distributed. This may be due to the fact that the scores were based upon opinion and the scores varied greatly among participants. The differences between the before and after scores did not vary greatly between all of the subjects. Although the Shapiro Wilks test of normality found most categories to not have data that were normally distributed, the researcher used this data within the study. The researcher chose to use the data even without a normal distribution of data because, the "paired samples t-test is fairly robust to deviations from normality" (Laerd Statistics, 2018).

Table 2.

Tests of Normality for Knowledge and Incorporation Difference

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
KLGOdifference	.150	31	.073	.932	31	.050
KLCOdifference	.184	31	.009	.898	31	.006
KLGLdifference	.147	31	.087	.948	31	.141
KLAGdifference	.197	31	.004	.922	31	.027
KLAOdifference	.229	31	.000	.876	31	.002
IIDdifference	.248	31	.000	.881	31	.002
IDLdifference	.259	31	.000	.877	31	.002
IAdifference	.234	31	.000	.882	31	.003
IUdifference	.234	31	.000	.882	31	.003

a. Lilliefors Significance Correction

Note. Table 2 notes the tests the normality of the constructs of teacher knowledge of standards and incorporation of standards. The sig. portion of the table provides whether the particular category was within normality. A $p < .05$ indicates data that is not normally distributed according to the Shapiro-Wilk Test of Normality.

The researcher tried to identify if there was a statistically significant difference in all nine areas of the two constructs. The five areas of knowledge level and four areas of incorporation were tested. The following table presents the mean difference, standard deviation, t-value, degrees of freedom, and statistical significance value. The values reported in Table 2 are based on knowledge level and incorporation level and Table 2 is a reference guide as all categories of knowledge were similar in mean, standard deviation, t value, and statistical significance.

Table 3.

Teacher Knowledge and Incorporation Difference Scores

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	KLGLA - KLGLB	2.121	2.219	.386	1.335	2.908	5.492	32	.000
Pair 2	KLGOA - KLGOB	2.515	1.906	.332	1.839	3.191	7.581	32	.000
Pair 3	KLCOA - KLCOB	2.606	2.193	.382	1.829	3.384	6.827	32	.000
Pair 4	KLAGA - KLAGB	1.939	1.936	.337	1.253	2.626	5.756	32	.000
Pair 5	KLAOA - KLAOB	2.606	2.045	.356	1.881	3.331	7.319	32	.000
Pair 6	IIDA - IIDB	2.625	2.211	.391	1.828	3.422	6.717	31	.000
Pair 7	IDLPA - IDLPB	2.364	1.884	.328	1.695	3.032	7.205	32	.000
Pair 8	IAA - IAB	2.606	2.235	.389	1.813	3.399	6.698	32	.000
Pair 9	IUPA - IUPB	2.60606	2.23522	.38910	1.81349	3.39864	6.698	32	.000

Note. Table 3 provides the mean difference score for the constructs of teacher knowledge and teacher incorporation. The mean difference is shown under the mean column. This is the mean difference of before and after scores for each specific category of knowledge and incorporation.

Participation in the PLCs elicited an increase of 1.939 to 2.606 with a standard deviation ranging from 1.906 to 2.219 in knowledge of standards on a scale of 1 to 10. The PLCs elicited a statistically significant increase in knowledge of standards with $t(32)=5.492$, $p < .000$. There was a statistically significant difference between means ($p < .05$), therefore we can reject the null hypothesis and accept the alternative hypothesis that PLCs with standard specific student achievement impact the level of teacher knowledge of standards. The mean difference for the five categories of teacher knowledge are displayed in Table 2.

Participation in the PLCs elicited an increase of 2.364 to 2.62 with a standard deviation ranging from 1.884 to 2.23 in incorporation of standards on a scale of 1 to 10. The PLCs elicited a statistically significant increase in incorporation of standards with $t(31)=6.717$, $p < .05$. There was a statistically significant difference between means ($p < .05$) therefore we can reject the null hypothesis and accept the alternative hypothesis that PLCs with standard specific student achievement impact the level of teacher incorporation of standards. The mean difference for the four categories of teacher incorporation are displayed in Table 2.

Research Question 2 Findings

The second research question was answered by three separate sets of survey questions and two sets of student achievement data. The construct of teacher knowledge of standards is comprised of five areas and represented by (Knowledgesum), incorporation is represented by (Incorporationsum), teacher's opinions of impact of PLCs on student achievement is (Opinionsum), and the last two years of student achievement data from the MCA-III and NWEA

tests is (SASUM). A separate set of student achievement data was the MCA-III scores from 2014 and the most recent set in 2019.

The second research question was looking for the correlation of knowledge and incorporation to student achievement. A Pearson's correlation was used to measure the correlation between level of knowledge, level of incorporation, and the last two years of student achievement grade level data per teacher. A correlation was measured between teacher opinion of PLCs impact on student achievement and the last two years of student achievement data for the teacher grade level. This statistical method was appropriate because, "the Pearson product-moment correlation is used to determine the strength and direction of a linear relationship between two continuous variables" (Laerd, 2018).

The null hypothesis for the second research question was, "increased teacher knowledge and incorporation of standards into instruction does not result in increased student achievement." The null hypothesis means that the Pearson's Correlation would not show a linear relationship between knowledge or incorporation of standards and student achievement. The dependent variables analyzed was the average of the knowledge and incorporation questions on the teacher survey and the student achievement scores on the MCA-III and the NWEA scores for each individual teacher for the years of 2018 and 2019.

To identify if there was a linear relationship, if there were outliers, and if the data were normally distributed, the researcher used SPSS 26. The researcher used a scatter plot to determine if there was a linear relationship between knowledge of standards, incorporation of standards, and the student achievement scores. Visually analyzing the scatter plot the researcher determined there was a linear relationship. To inspect the scatter plot please refer to Appendix F.

To identify if the data was normally distributed the researcher used a Shapiro-Wilk test. The student achievement scores were normally distributed with a ($p > .05$). The knowledge of standards, incorporation of standards, and opinion of PLCs of impact on student achievement all had ($p < .05$) and were not normally distributed. These values had a wide range of distribution because of the wide ranging opinions on the survey. The researcher chose to run the Pearson's Correlation with the data not meeting normality because, the Pearson's Correlation is somewhat robust to deviations from normality (Laerd, 2018). The tests of normality are displayed in Table

Table 4.

Student Achievement, Knowledge, Incorporation, and Opinion Sums

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SASUM	.129	23	.200*	.947	23	.259
Knowledgesum	.259	23	.000	.722	23	.000
Opinionsum	.241	23	.001	.827	23	.001
Incorporationsum	.282	23	.000	.662	23	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note. The tests of normality for student achievement, knowledge, incorporation, and opinion sums give the overall average of differences for each category. The sig. portion of the table provides whether the particular category was within normality. A $p < .05$ indicates data that is not normally distributed according to the Shapiro-Wilk Test of Normality.

SPSS was used to detect outliers for each subject within the constructs. SPSS found outlier scores for knowledge, opinion, and incorporation. As there were only one outlier score detected in each area, the outlier scores were included in the data as inspection of their values did

not reveal them to be data entry errors or survey errors. Also, the outlier scores did not influence the overall data set significantly. The outliers are present in the scatterplot charts in Appendix F.

The Pearson's Correlation has a small correlation if the value is between .1 and .3, there is medium to moderate correlation from .3 and .5, and there is a strong correlation if the value is greater than .5 (Laerd, 2018). There was a small correlation of teacher opinion of incorporation of standards to student achievement, $r(21) = .234$, $p < .001$. There was a mild correlation of teacher knowledge of standards to student achievement among students, $r(21) = .456$, $p < .001$. There was a strong correlation between teacher opinion of impact of PLCs with standard specific student achievement scores to student achievement among students, $r(21) = .599$, $p < .001$.

Table 5.

Correlations of Student Achievement to Opinion of PLCs, Incorporation, and Knowledge

Correlations

		SASUM	Opinionsum	Incorporationsum	Knowledgesum
SASUM	Pearson Correlation	1	.599**	.234	.456*
	Sig. (2-tailed)		.003	.282	.029
	N	23	23	23	23
Opinionsum	Pearson Correlation	.599**	1	.112	.168
	Sig. (2-tailed)	.003		.536	.351
	N	23	33	33	33
Incorporationsum	Pearson Correlation	.234	.112	1	.736**
	Sig. (2-tailed)	.282	.536		.000
	N	23	33	33	33
Knowledgesum	Pearson Correlation	.456*	.168	.736**	1
	Sig. (2-tailed)	.029	.351	.000	
	N	23	33	33	33

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Note. Table 5 notes the correlation between student achievement, opinion of PLCs, incorporation of standards, knowledge of standards. The correlation of each category is shown for each category labeled on the left of the table. For SASUM the correlation to Opinionsum is .599, Incorporationsum is .234, and Knowledgesum is .456.

The researcher also used a paired sample t-test to measure the difference of student achievement scores before the PLCs with standard specific student achievement scores that took place and the last year in which there are student achievement scores for the district. The researcher only used MCA-III data for this test as NWEA data were not available for this data set. There were no outliers in the data, as assessed by inspection of a boxplot. See Appendix G. The differences between the 2014 student achievement scores and 2019 student achievement

were normally distributed, as assessed by the Shapiro-Wilk's test (p = .436). The test of normality is displayed in table 6.

Table 6.

Tests of Normality for Student Achievement Difference

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
DifferenceSA1419	.131	17	.200*	.949	17	.436

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note. Table 6 notes the Shapiro-Wilk test of normality for the difference between the student achievement scores in 2014 and 2019. The normality is noted in the Sig. column. A p > .05 indicates data that is normally distributed according to the Shapiro-Wilk Test of Normality.

The researcher identified there was a statistically significant difference between the school district student achievement scores in 2014 before the PLCs and 2019 after five years of PLCs. Table 7 presents the mean difference, standard deviation, t-value, degrees of freedom, and statistical significance value. The values reported below are based on the student MCA-III and NWEA scores for the district in 2014 and 2019. Participation in the PLCs elicited a mean increase of 10.4% on a 100 point scale with a standard deviation of 12.74. The PLCs elicited a statistically significant increase in student achievement with $t(116)=3.36$, $p < .05$. There was a statistically significant difference between means ($p < .05$) therefore we can reject the null hypothesis and accept the alternative hypothesis that increase in teacher knowledge and incorporation of standards impact the level student achievement.

Table 7.

Student Achievement Difference

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	SA2019 - SA2014	10.40000	12.74058	3.09005	3.84940	16.95060	3.366	16	.004

Note. Table 7 provides the mean difference in student achievement scores from 2014 versus 2019. The Mean column provides the difference between the scores in 2014 to 2019. The Mean of 10.4 is the difference in proficiency rates.

Summary

The paired samples t-test found that there was a statistically significant increase in the mean difference of teacher's knowledge and incorporation of standards after PLCs with standard specific student achievement scores. The Cohens d effect size is "an attempt to provide a measure of the practical significance of the result" (Laerd, 2018). The Cohens d effect size was greater than .8 for all categories which suggests the PLCs with standard specific student achievement scores had a large impact on teacher's knowledge and incorporation of standards.

The Pearson's Correlation was used to measure the impact of the increase of teacher knowledge of standards and incorporation of standards on student achievement. There was a small correlation between incorporation and student achievement, a medium correlation between knowledge of standards and student achievement, and a large correlation between teacher's opinion of PLCs impact on student achievement scores and student achievement scores. The

correlation suggests the direct impact of PLCs on knowledge and incorporation, which then impacts student achievement.

The paired samples t-test also found that there was a statistically significant increase in the mean difference of student achievement before and after the PLCs. The t-test measured the difference between MCA-III scores in 2014 and 2019. The mean difference was 10.4 points on a 100 point scale. The Cohens d effect size was .81 for student achievement which suggests a large effect size on student achievement.

The statistical analysis of the survey results and student achievement data provided points that aligned with the literature. The two paired sample t-tests and the Pearson's Correlation showed the impact of PLCs with standards specific student achievement scores on knowledge, incorporation, and student achievement. Based upon the quantitative data provided from the survey, student achievement scores, and SPSS 26 the researcher can reject the null hypotheses of:

1. Participation in PLCs has no impact on teachers' knowledge and incorporation of standards into instruction.
2. Increased teacher knowledge and incorporation of standards into instruction does not result in increased student knowledge.

The correlation of opinion of PLCs impact on student achievement was an unexpected result. A detailed analysis of the quantitative data is presented in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

Education is a changing environment. Educators are on a constant quest to find the best methods to teach students. This quest is often shaped by legislation and policy at the national and state level. Karr, Marsh, Ikemoto, Darilek, and Barney (2006) detailed how the legislation has created an environment in education that requires districts to monitor progress on standards and hold districts accountable. This shift in education has resulted in news ways to try and improve education. According to Lai and McNaughton (2016) "there is an increasing international emphasis on using data as part of teacher and school leader decision-making to improve teaching and student achievement" (p. 1). The increase in data usage as part of decision making has brought about many data types and processes to use data. There are many different types of data that we have access to, but the question remains of what type of data is impactful for educators to use and what are the processes that most effectively use that data.

The research was driven by the researcher's professional experiences in the PK-12 educational setting in Minnesota. The researcher has been a teacher and educational leader of multiple PK-12 school who has been tasked with continuous improvement of student achievement and the professional development of educators. The researcher arrived in the district where the study was conducted seven years ago when student achievement scores were well below the state average and there was not an element of data review in the district. The researcher implemented a PLC system that analyzed standard specific student achievement scores for the district. Standard specific student achievement scores were a new concept from the Minnesota Department of Education. There was not a breadth of research on the impact of using this new type of data from the Minnesota Department of Education on student achievement.

The study was driven by the researcher's curiosity if the new data type used in the PLC system was impactful of teacher knowledge of standards, incorporation of standards, and if those constructs impacted student achievement. The researcher also had a personal curiosity if the teachers within the district felt the PLCs with this data type improved their knowledge and incorporation of standards and whether they found the PLCs impactful. Those experiences helped to move the researcher to help fill the void in literature on the subject and identify if the PLCs using this data type were an impactful practice. The main research question and sub question are:

Within the context of PLCs (data-based teams) utilizing standard specific student achievement data to examine teacher knowledge and incorporation of standards into classroom instruction and learning:

1) What impact, if any, was the use of PLCs on the teachers' knowledge and incorporation of standards into the classroom setting?
2) Did student achievement on standardized tests improve as the result of the level of teacher knowledge and incorporation of standards into the classroom?

A quantitative study using a teacher survey data and student achievement data was selected as the best approach for the study. The researcher was a principal and superintendent in the district where the study took place allowing for access to the staff and student achievement data. The survey analyzed thirty-three responses using a Likert scale on the constructs of teacher knowledge of standards, teacher incorporation of standards, and effectiveness of PLCs using standards specific student achievement data. Student achievement data was from the MCA-III and NWEA tests.

The statistical analysis of the survey and student achievement data revealed statistically significant increases in teacher knowledge and incorporation of standards. There was also a small correlation between incorporation of standards and student achievement, a medium correlation between teacher knowledge and student achievement, and a large correlation between teacher opinion of PLCs and student achievement. Finally, there was a statistically significant increase in the district MCA-III student achievement scores before the PLCs took place in 2014 and after in 2019.

Interpretation of the Findings

The findings of this study aligned with the literature on conditions of impactful data based decision making, conditions of impactful PLCs, and the impact of standards and incorporation on student achievement. The findings also confirmed the limited literature on standard specific student achievement scores and their impact on student achievement. The PLCs with standard specific student achievement did increase teacher knowledge and incorporation of standards, which in turn impacted student achievement. There was an unexpected result in the correlation of teacher opinion of PLCs and student achievement. The following interpretation provides a synthesis of quantitative data to provide a robust view of the impact of standards specific student achievement scores and their impact.

The paired t-test analysis of the knowledge of standards showed a consistent increase of knowledge of standards in all five areas of the construct. The highest increase in knowledge came from the area of (KLCO) knowledge level of standards included in curriculum. The lowest increase came in (KLAG) knowledge level of standards in standardized tests. Although the study saw differences in level of increase of knowledge of standards in different areas, we saw a generalized increase of about two points on a 10 point Likert scale for all areas of knowledge.

The study saw a statistically significant increase in knowledge and a practical increase as well. The increase was consistent across all areas of knowledge of standards, which suggests that the PLCs were impactful increasing the knowledge of teachers on standards.

The paired t-test analysis of the incorporation of standards also showed a consistent increase of incorporation of standards in all four areas of the construct. The highest increase in incorporation came from incorporation of standards into daily instruction (IID) and the lowest increase was in the area of incorporation of standards into daily lesson planning (IDLP). The data showed a generalized increase of about 2.5 points on a 10 point Likert scale for all areas of incorporation. The data showed a statistically significant increase in incorporation and a practical increase as well. The increase was higher than the increase in knowledge, which suggests the PLCs were impactful on incorporation, and more impactful on incorporation than knowledge.

The Pearson's correlation between knowledge and incorporation of standards and student achievement was an important correlation. Although there was only a small correlation between incorporation and a medium correlation between knowledge, the correlation was statistically significant and practically significant. The correlation of both subjects to student achievement shows that knowledge and incorporation have a direct impact on student achievement. There was limited literature on whether teacher knowledge or incorporation impacts student achievement. This correlation helps solidify that knowledge and incorporation do impact student achievement. Although the survey showed a higher increase in incorporation than knowledge from the PLCs, knowledge of standards showed a stronger correlation which could suggest standards knowledge having a greater impact on student achievement.

The Pearson's correlation between teacher opinion of PLCs and student achievement was the surprising result. There was a statistically strong correlation between teacher opinion of the

PLCs impact on student achievement and student achievement. The practical impact of this data is questionable, but the correlation shows that if teachers believe these PLCs are impactful then they are more likely to have high student achievement.

The last paired t-tests analyzed MCA-III student achievement scores from 2014 before PLCs took place and in 2019 after PLCs had taken place for five years. The mean difference of the student achievement scores for all three subjects was 10.4 on a 100 point scale. This was a statistically significant change in student achievement. This data is also practically significant for school districts. There was an average increase of 10% across the range of all three subjects. Over five years this equates to 2% per year. According to the Minnesota Depart Education Report Card, from 2015-2019 years there has been a decrease in student achievement of 4.6% in math, a 2.7% decrease in Science, and a .3% decrease in reading. This means as all categories of student achievement in Minnesota have been decreasing, while student achievement in the district that used PLCs with standard specific student achievement scores have been increasing. This was statistically significant and practically significant as the methods used could have had a direct impact on the student achievement increases.

Implications for Practice

The study showed increases in teacher knowledge and incorporation, increases in district student achievement, and correlations between the knowledge, incorporation, opinion of PLCs and student achievement. This study and the literature provide an outline of conditions for school districts to use in PLCs to increase student achievement. The study also provides a guide for testing companies, state organizations, and legislators on the type of high quality data that educators need to improve student achievement.

The literature provided conditions that can help make PLCs impactful. Professional development or PLCs that are collaborative, ongoing, and focused were found to be effective for educators (Penuel, Fishman, Yamaguchi, & Gallagher 2007, Templeton and Willis 2017, Ruchti, Jenkins, and Agamba 2013, Goddard and Goddard 2007). The research study used PLCs that were collaborative, ongoing, and focused and this was again shown to be impactful conditions through the consistent rise in teacher knowledge and incorporation of standards.

The consistent rise of both teacher knowledge and incorporation gives us a good view of the impactfulnes of analyzing standards using standard specific student achievement scores. The methods used and the data type use give us an overall format of what school districts can use to increase both teacher knowledge and incorporation of standards. The strong correlation of opinion of PLCs to student achievement gives rise to the question of how to make PLCs meaningful to educators.

Limitations of the Study

There were some limitations to the study and data presented. The limitations included the researcher being an administrator in the district, the outliers in the data set, and the normality tests of the data presented. Although there were limitations the researcher does not believe they significantly impacted the study.

The researcher was an administrator in the district during the study. This could impact survey results with the administrator being the direct supervisor of the respondents of the survey. The researcher did use an anonymous survey to gather teacher opinion of the subjects, but it cannot be overlooked that the researcher had direct influence over the respondents.

SPSS 26 did identify outliers in the data sets of knowledge, incorporation, and opinions in the survey. Although outliers were identified within the data set the researcher used the

outliers. The outliers were used because it was not evident that these values were data entry or technical errors. The outliers did not impact the overall mean scores by a large factor and thus they were still used in the data sets.

Tests of normality were used and there were data sets that were not found to comply with normality using the Shapiro Wilks test. The data sets that were not found to be within normality were the differences in knowledge and opinion and the knowledge, incorporation, and opinion sums. Although normality was not found within the data sets the researcher used the data sets because the both the paired samples t-test and Pearson's correlation are robust to data sets that are not normal. The cause of a not normal data set could be the result of a small sample size of thirty-three respondents and that the survey was based upon opinion, which can be wide ranging.

Recommendations

There are a few areas the researcher feels this study could be expanded on for future study. The research presented was done on a small scale in a single district. Expanding the size of this study in multiple districts could help find the impact of standards specific student achievement data. Along with this data type, there was limited research on the impact of knowledge and incorporation of standards on student achievement. Large scale studies on the impact of teacher knowledge and incorporation of standards could be impactful for future resource allocation. Finally, the surprise area of data was the teacher opinion of the PLCs themselves and its correlation to student achievement.

Expanding the size of using PLC's with a similar structure with standard specific student achievement could help provide definitive evidence of the impact of this type of data on student achievement. Schools spend millions of dollars on staff development and many other strategies to improve student achievement. If using the PLC process with this data type is found impactful

for student achievement, we can provide a blueprint of a process for other districts. Along with providing a blueprint for other districts on a process for improving achievement, solidifying the research on this topic can help influence policy and legislation for resource allocation for education. The state spends millions of dollars on initiatives to improve achievement. Providing solidified research can help provide information to our decision makers on how to allocate resources to help improve achievement.

There was scant literature on the impact of knowledge and incorporation of standards on student achievement. The study showed a small correlation between incorporation and student achievement and a medium correlation between knowledge and student achievement. A large scale study in Minnesota on the impact of knowledge and incorporation of standards on student achievement could be a benefit to districts and the state education system. This would be possible by using district averages of teacher knowledge and incorporation and student achievement scores.

The surprise area of the study was the strong correlation between the teacher opinion of PLCs with standards specific student achievement and student achievement. The teachers who had the most positive opinion of the PLCs had the strongest correlation to high student achievement. The question comes about why is this correlation happening? Is it the belief in the importance of standards, belief in the use of data, or the way in which the PLCs were formatted that caused this correlation? There are a variety of ways to approach this topic, but the researcher feels it deserves further exploration.

Conclusions

There has been a large body of research on PLCs, data-based decision making, and student achievement. What has not been analyzed is if specific types of data are impactful on

teachers and student achievement. The study attempted to find if the new data type of standard specific student achievement scores was an impactful data type.

The study was clear that PLCs with standard specific student achievement data had statistically significant impacts on teacher knowledge and teacher incorporation of standards. The impact of the PLCs with standard specific student achievement data was not only statistically significant, but practically significant and consistent. The different categories within the constructs of knowledge and incorporation all had a consistent increase. Consistent increases in all the categories gives a clear picture of the impact of the PLCs and type of data.

The correlation of teacher knowledge and incorporation to student achievement gives a clear picture that these areas are important for student achievement. Although knowledge had a stronger correlation, both topics are important for student success. The study provides a direction for which we can direct resources when looking at improving student achievement. There are many variables that can impact student achievement, but both these categories have a discernable impact.

The surprise area of the study was the teacher opinion of the PLCs that were conducted and the strong correlation to student achievement. This is an area in need of further study. What causes the link between teacher opinion of a process and student achievement? Does the educator's view of standards and data based decision making impact their overall view of the PLCs? Does an educator's overall view of the worthiness of these topics have a direct correlation to student achievement? There are many questions to be answered with this topic.

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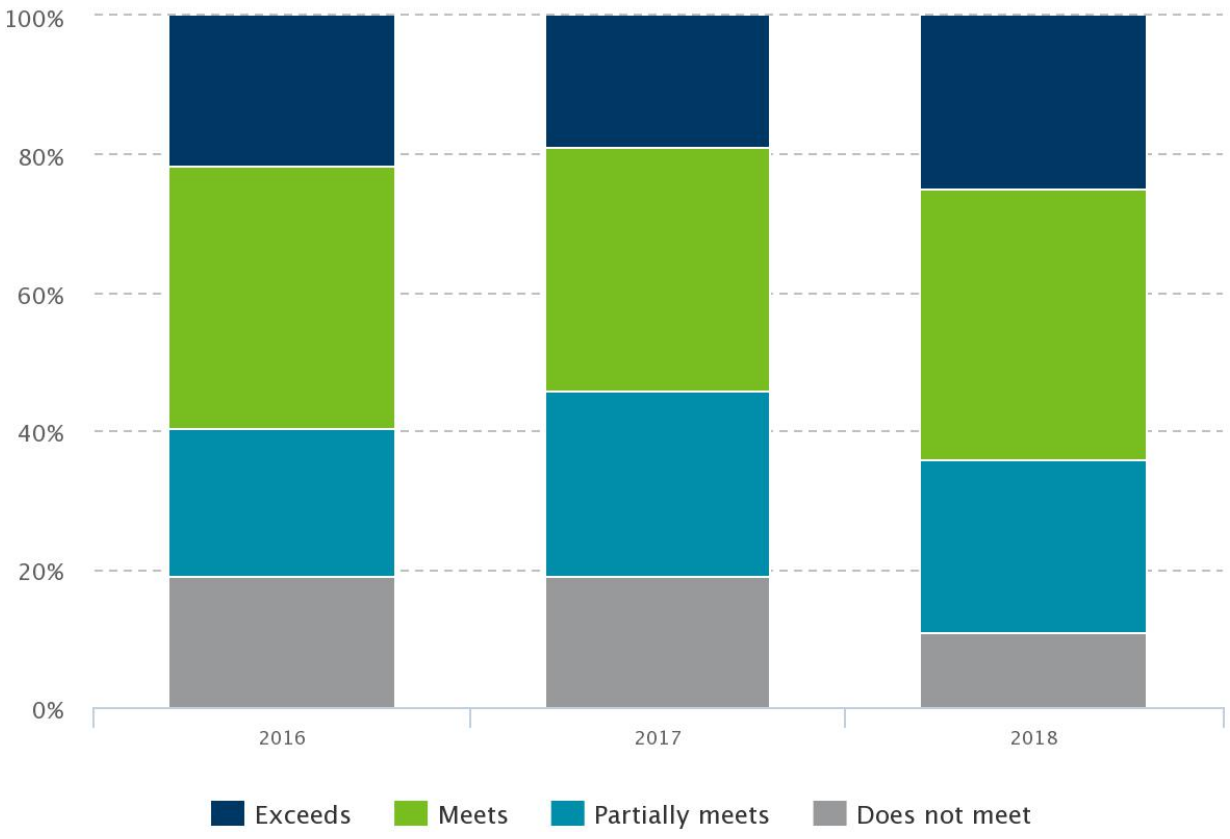
Appendix A.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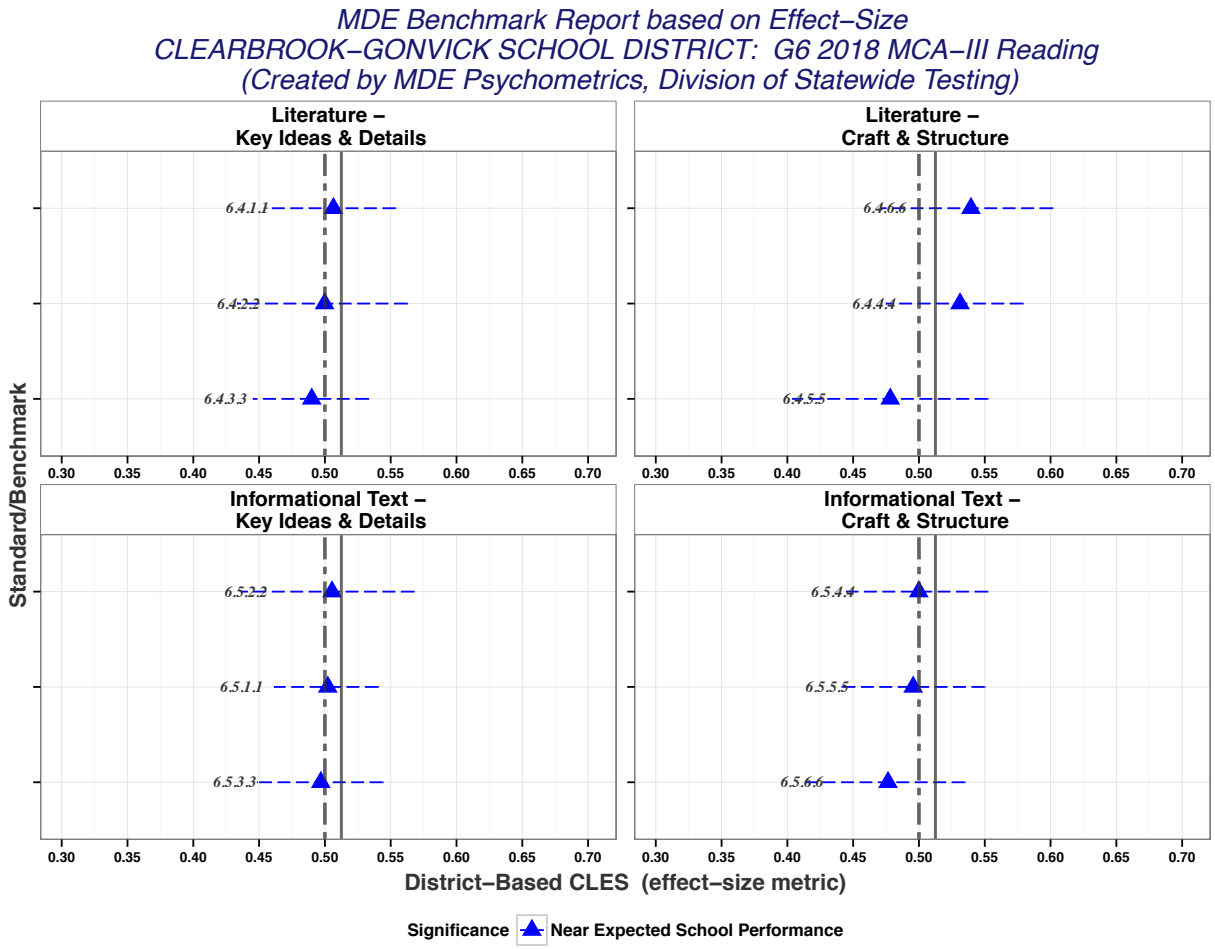
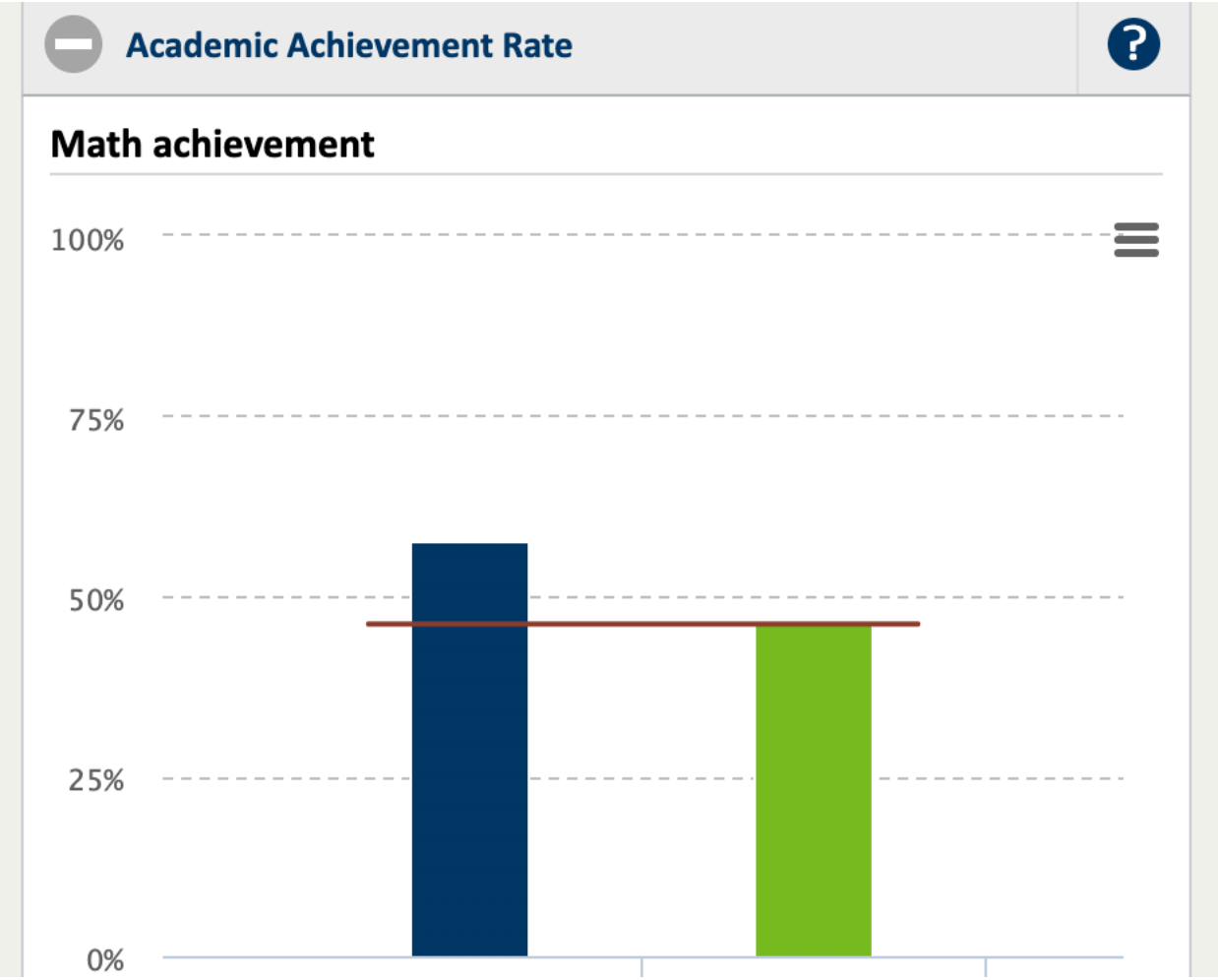
40%
20%
0%
2016
2017
2018
Exceeds
Meets
Partially meets
Does not meet

Appendix B.


MDE Benchmark Report based on Effect–Size
CLEARBROOK–GONVICK SCHOOL DISTRICT: G6 2018 MCA–III Reading
(Created by MDE Psychometrics, Division of Statewide Testing)
Literature – Key Ideas & Details
Literature – Craft & Structure
Informational Text – Key Ideas & Details
Informational Text – Craft & Structure
6.4.1.1
6.4.2.2
6.4.3.3
6.4.6.6
6.4.4.4
6.4.5.5
6.5.2.2
6.5.1.1
6.5.3.3
6.5.4.4
6.5.5.5
6.5.6.6
0.30 0.35 0.40 0.45 0.50 0.55 0.60 0.65 0.70
Standard/Benchmark
District–Based CLES (effect–size metric)
Significance
Near Expected School Performance

Appendix C.



Appendix D.

Standards Specific Student Achievement Scores

Dear Participant,

You are invited to participate in a study of Standard Specific Student Achievement Scores and Their Impact. I hope to learn how the use of standard specific student achievement scores impact teachers understanding of state standards, incorporation of state standards, and opinion of importance of state standards. You were selected as a possible participant in this study because you have participated in PLC's focused on benchmark reports.

If you decide to participate, please complete the enclosed survey. Your return of this survey is implied consent. The survey is designed to gauge the understanding of state standards, incorporation of state standards, and opinion of importance of state standards before and after PLC participation. It will take about 10 minutes to complete the survey. No benefits accrue to you for answering the survey, but your responses will be used to help identify the impact of benchmark reports. Any discomfort or inconvenience to you derives only from the amount of time taken to complete the survey.
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will not be disclosed.

Your decision whether or not to participate will not affect your future relationships with the Jeff Burgess or the Clearbrook-Gonvick School District. If you decide to participate, you are free to discontinue participation at any time.
Please feel free to ask questions regarding this study. You may contact me later if you have additional questions contact Boyd Bradbury, Department of Education Leadership, bradbury@ mnstate.edu Any questions about your rights may be directed to Dr. Lisa I. Karch, Chair of the MSUM Institutional Review Board at 218-477-2699 or by e-mail at: irb@mnstate.edu.

Thank you for your time.

Sincerely,
Jeff Burgess

Number of years teaching

- ○ 0-5
- ○ 6-10
- ○ 10-15
- ○ 15-20
- ○ More than 20

Subject

- ○ Elementary
- ○ Math
- ○ Science
- ○ ELA
- ○ Other

Gender

- ○ Male
- ○ Female

Age

- ○ 20-30
- ○ 30-40
- ○ 40-50
- ○ 50 or over

How many years have you participated in PLC's with Benchmark data review

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

What was your knowledge level of Minnesota State Standards in your grade level and content area before PLCs with Benchmark Report review? Rank 1- know no Minnesota State Standards to 10-know all Minnesota State Standards.

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your knowledge level of Minnesota State Standards in your grade level and content area after PLCs with Benchmark Report review? Rank 1- know no Minnesota State Standards to 10-know all Minnesota State Standards.

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your knowledge level of Minnesota State Standards outside your grade level and content area before PLCs with Benchmark Report review? Rank 1- know no Minnesota State Standards to 10-know all Minnesota State Standards.

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your knowledge level of Minnesota State Standards outside your grade level and content area after PLCs with Benchmark Report review? Rank 1- know no Minnesota State Standards to 10-know all Minnesota State Standards.

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

What was your knowledge level of Minnesota State Standards included in curriculum in your grade level and content area before PLCs with Benchmark Report review? Rank 1- know no Minnesota State Standards to 10-know all Minnesota State Standards.

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

What was your knowledge level of Minnesota State Standards included in curriculum outside your grade level and content area after PLCs with Benchmark Report review? Rank 1-know no Minnesota State Standards to 10-know all Minnesota State Standards

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

What was your knowledge level of Minnesota State Standards included in standardized tests in your grade level and content area before PLCs with Benchmark Report review? Rank 1-know no Minnesota State Standards to 10-know all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your knowledge level of Minnesota State Standards included in standardized tests in your grade level and content area after PLCs with Benchmark Report review? Rank 1-know no Minnesota State Standards to 10-know all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your knowledge level of Minnesota State Standards included in standardized tests outside your grade level and content area before PLCs with Benchmark Report review? Rank 1-know no Minnesota State Standards to 10-know all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your knowledge level of Minnesota State Standards included in standardized tests outside your grade level and content area after PLCs with Benchmark Report review? Rank 1-know no Minnesota State Standards to 10-know all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into daily instruction before PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into daily instruction after PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into daily lesson planning before PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into daily lesson planning after PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into assessment before PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

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What was your level of incorporation of Minnesota State Standards into assessment after PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into unit planning before PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

What was your level of incorporation of Minnesota State Standards into unit planning after PLC's with Benchmark Report review? Rank 1-incorporate no Minnesota State Standards to 10-incorporate all Minnesota State Standards

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

PLC's with Benchmark Report review of Minnesota State Standards provide information that helps you improve student achievement. Rank from 1-Strongly Agree to 10 Strongly Disagree.

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

PLC's with Benchmark Report review from Minnesota State Standards help identify effective instructional practices that lead to improved student achievement Rank from 1-Strongly Agree to 10 Strongly Disagree.

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

Student Achievement. PLC's with Benchmark Report review from the Minnesota State Standards help guide student learning for student achievement.. Rank from 1-Strongly Agree to 10 Strongly Disagree.

1 2 3 4 5 6 7 8 9 10

○ ○ ○ ○ ○ ○ ○ ○ ○ ○

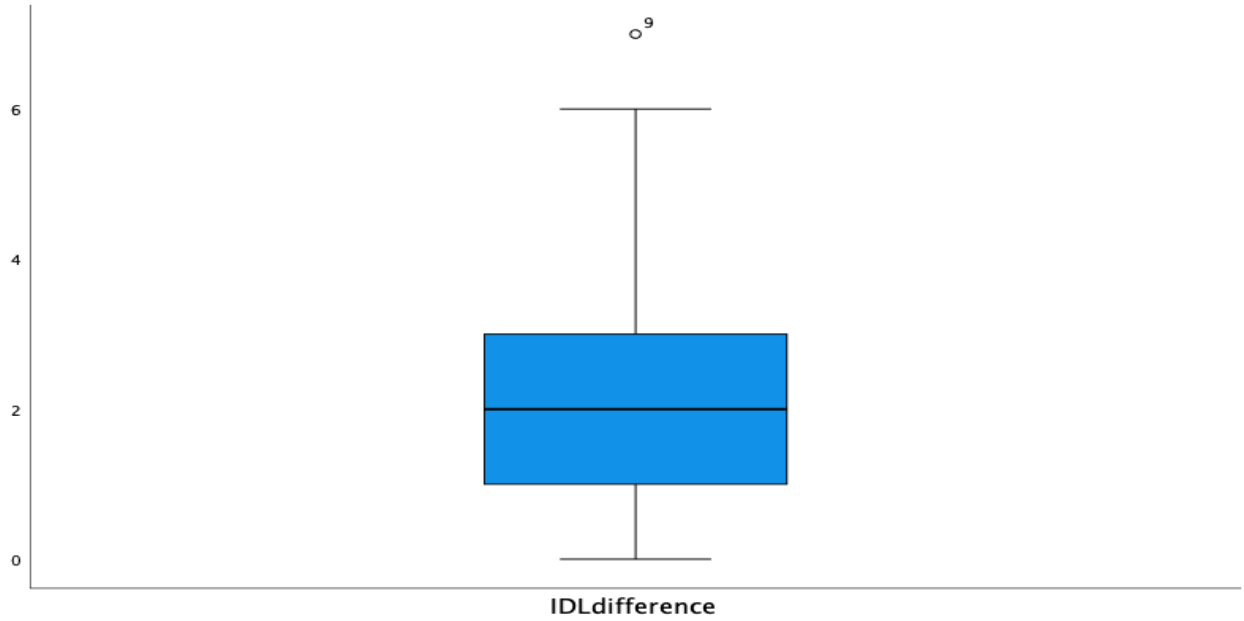
PLC's with Benchmark Report review from the Minnesota State Standards help make you a more effective instructor to improve student achievement. Rank from 1-Strongly Agree to 10 Strongly Disagree.

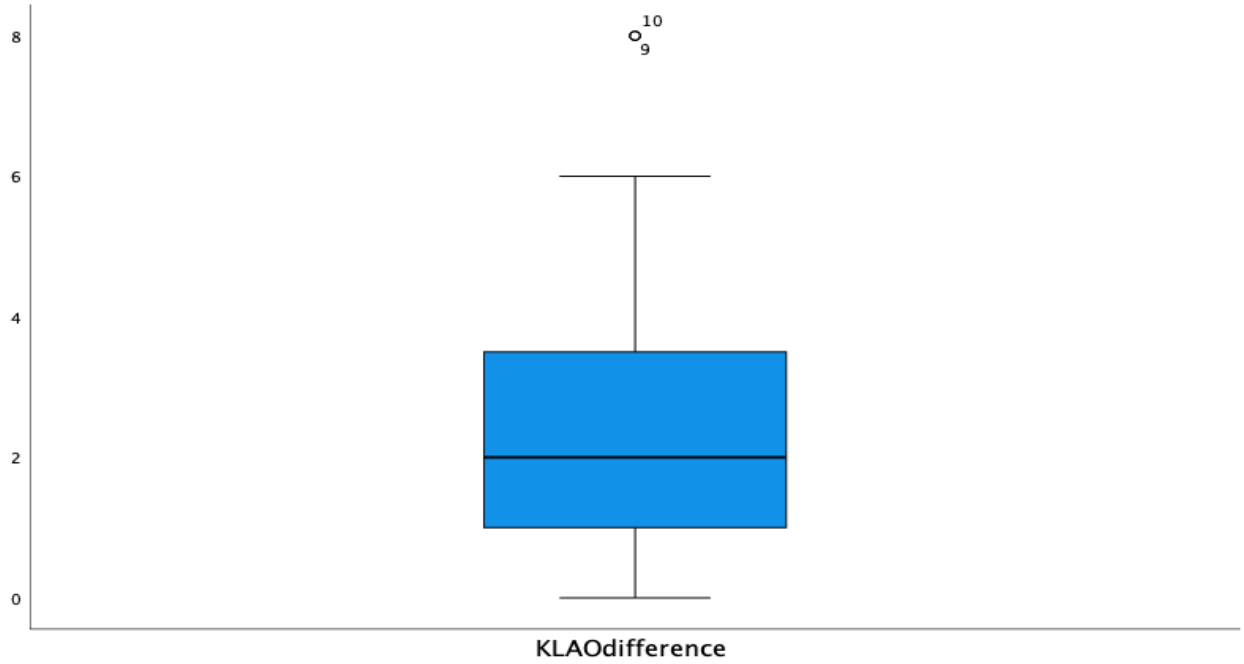
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

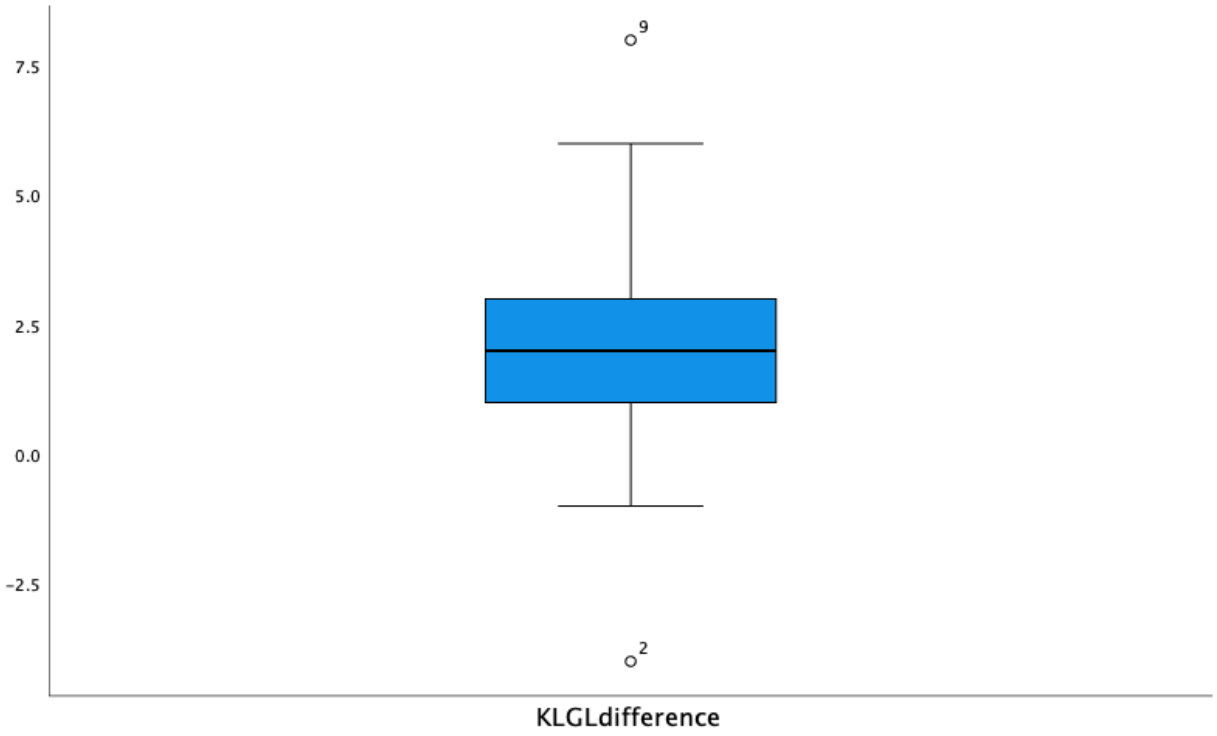
PLCs with Benchmark report review has increased your students achievement. Rank from 1-Strongly Agree to 10- Strongly Disagree.

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Appendix E.



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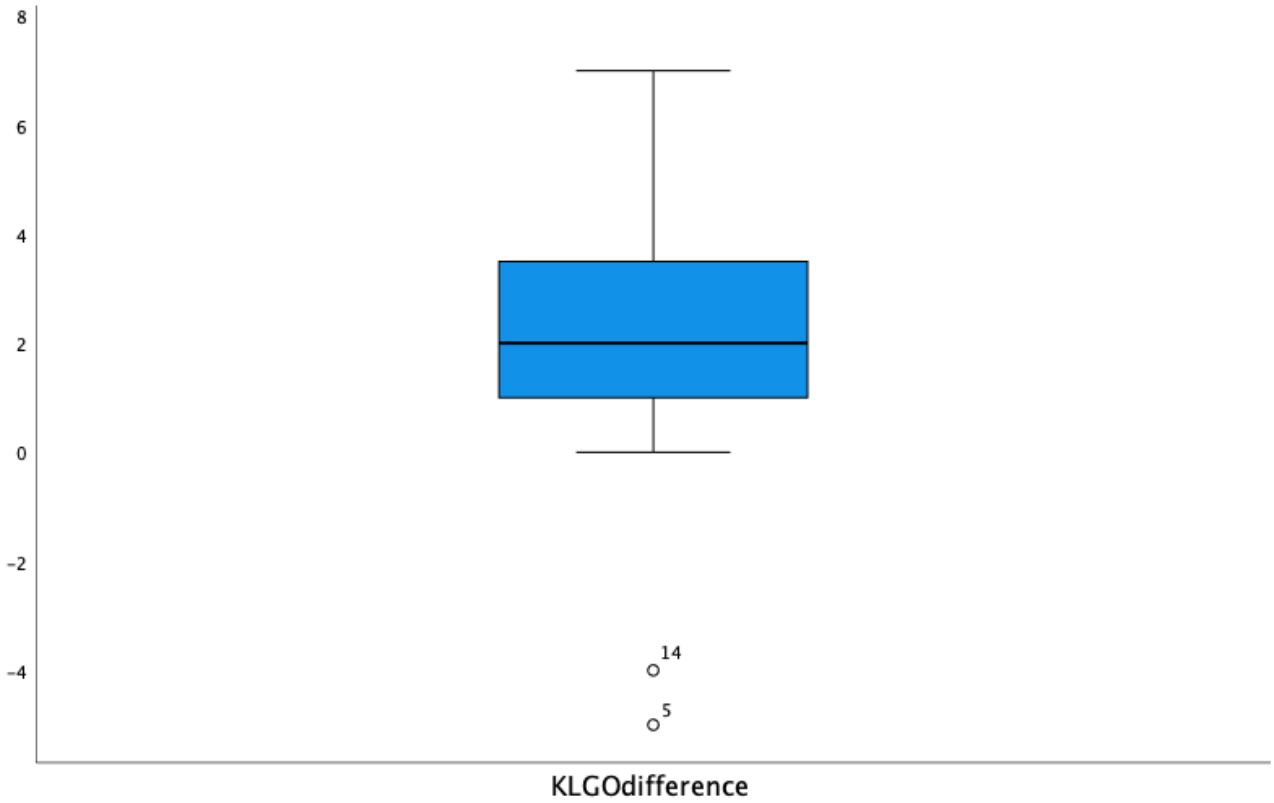
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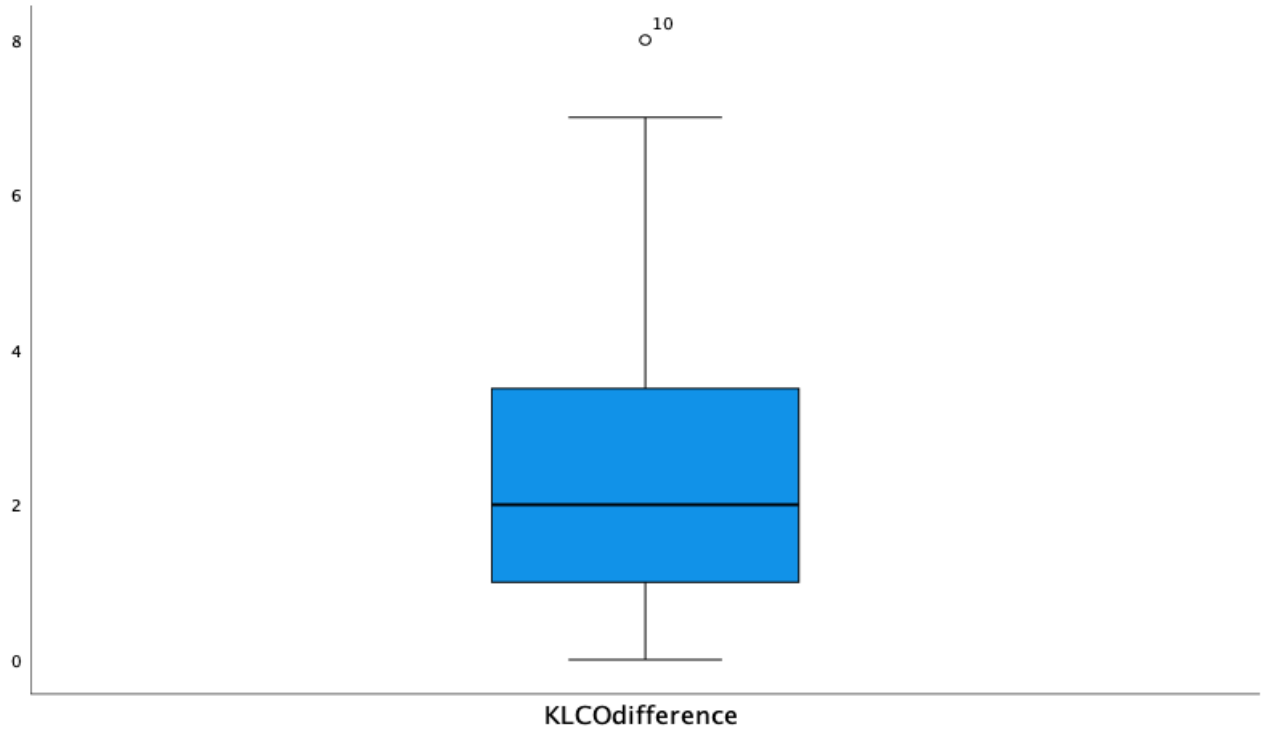
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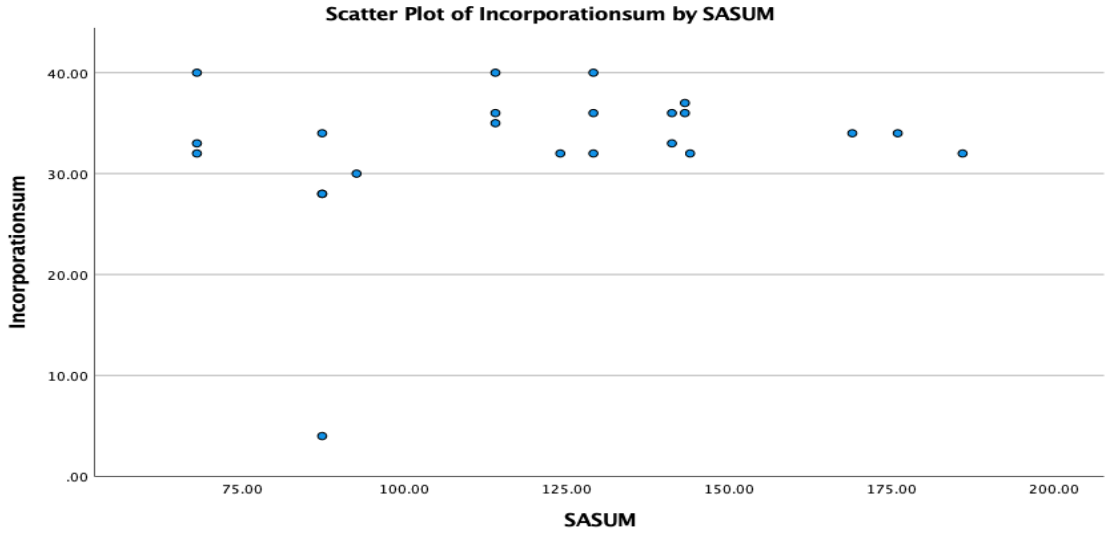
Appendix F.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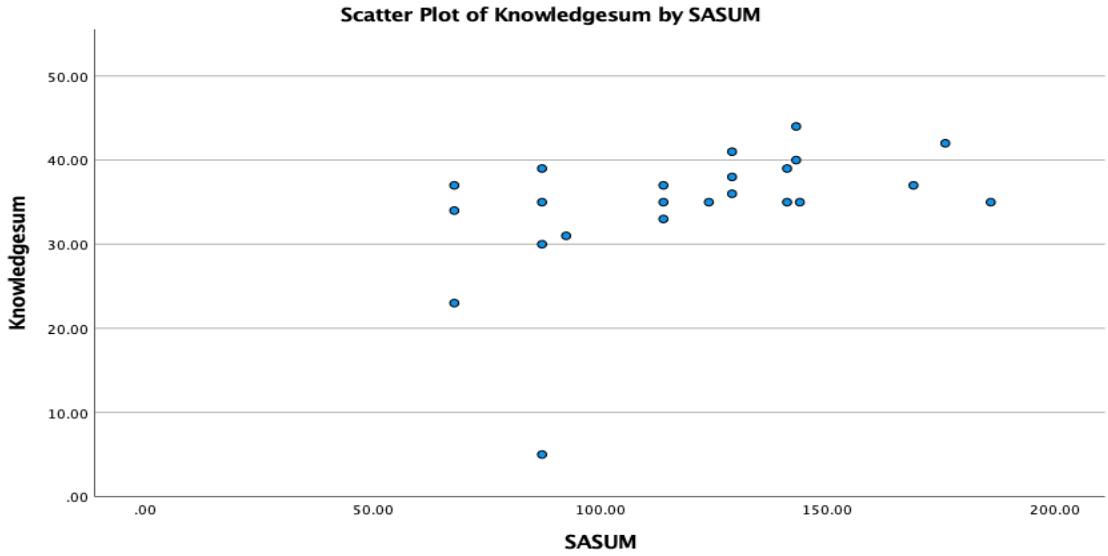
SASUM


Scatter Plot of Knowledgesum by SASUM
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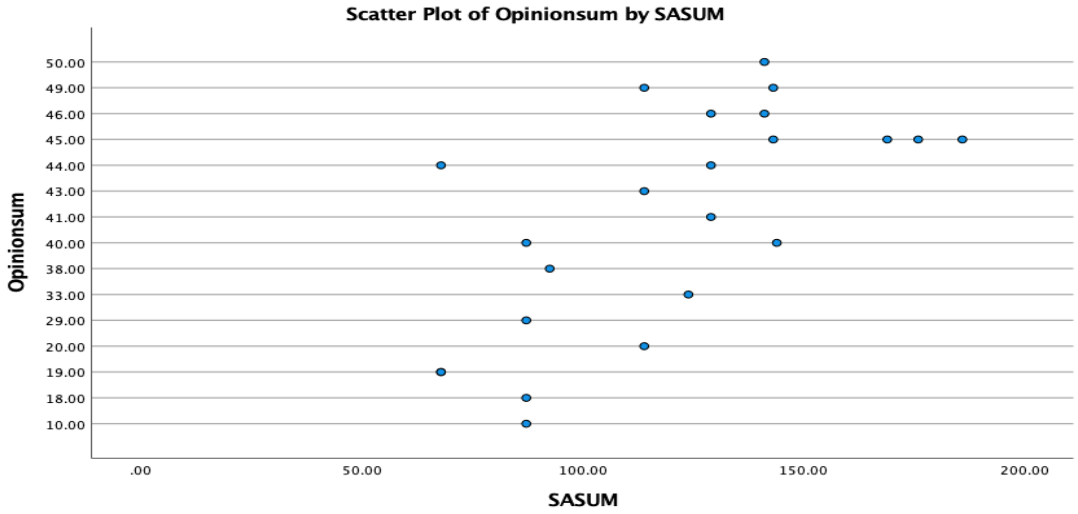
Scatter Plot of Opinionsum by SASUM
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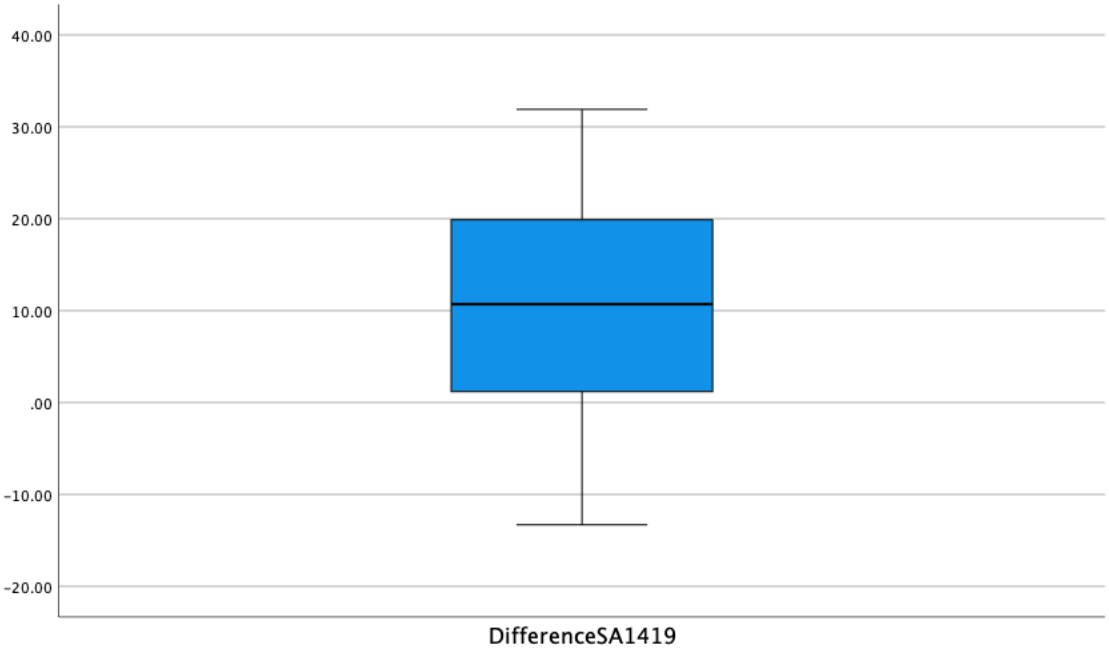
Appendix G.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